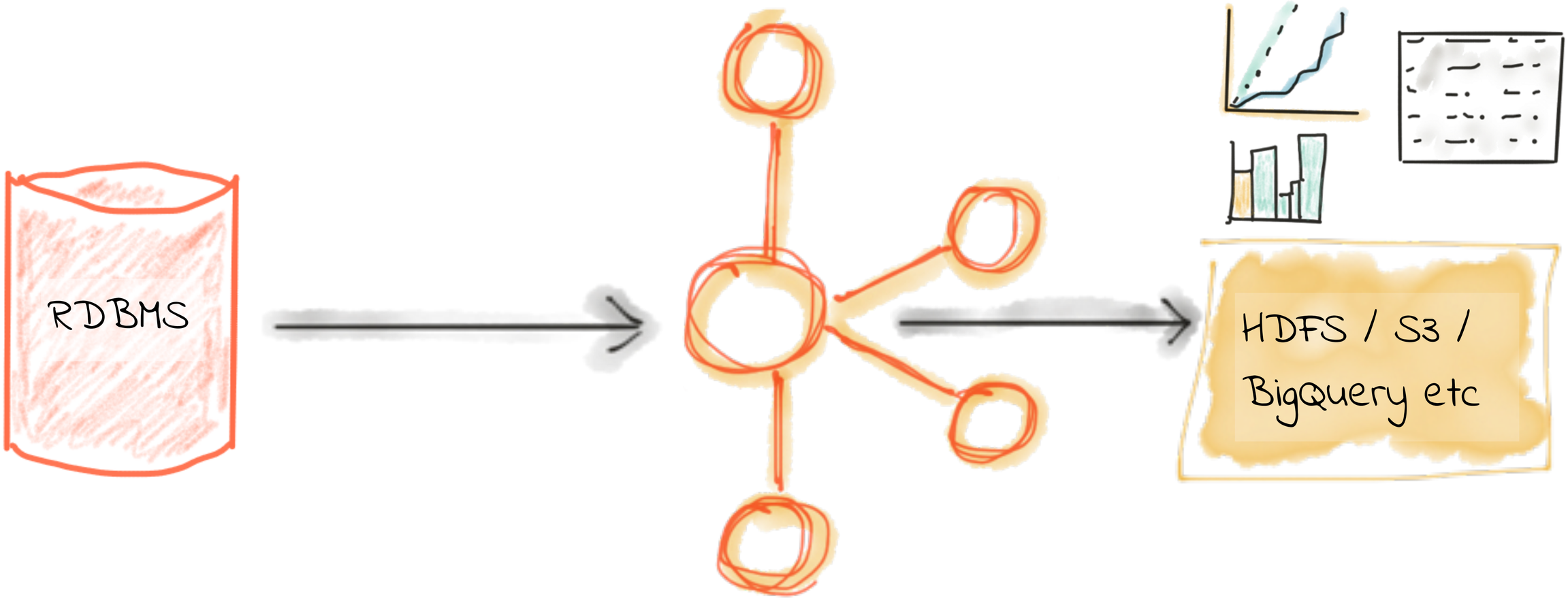
Integrating Databases and Apache Kafka®

@rmoff

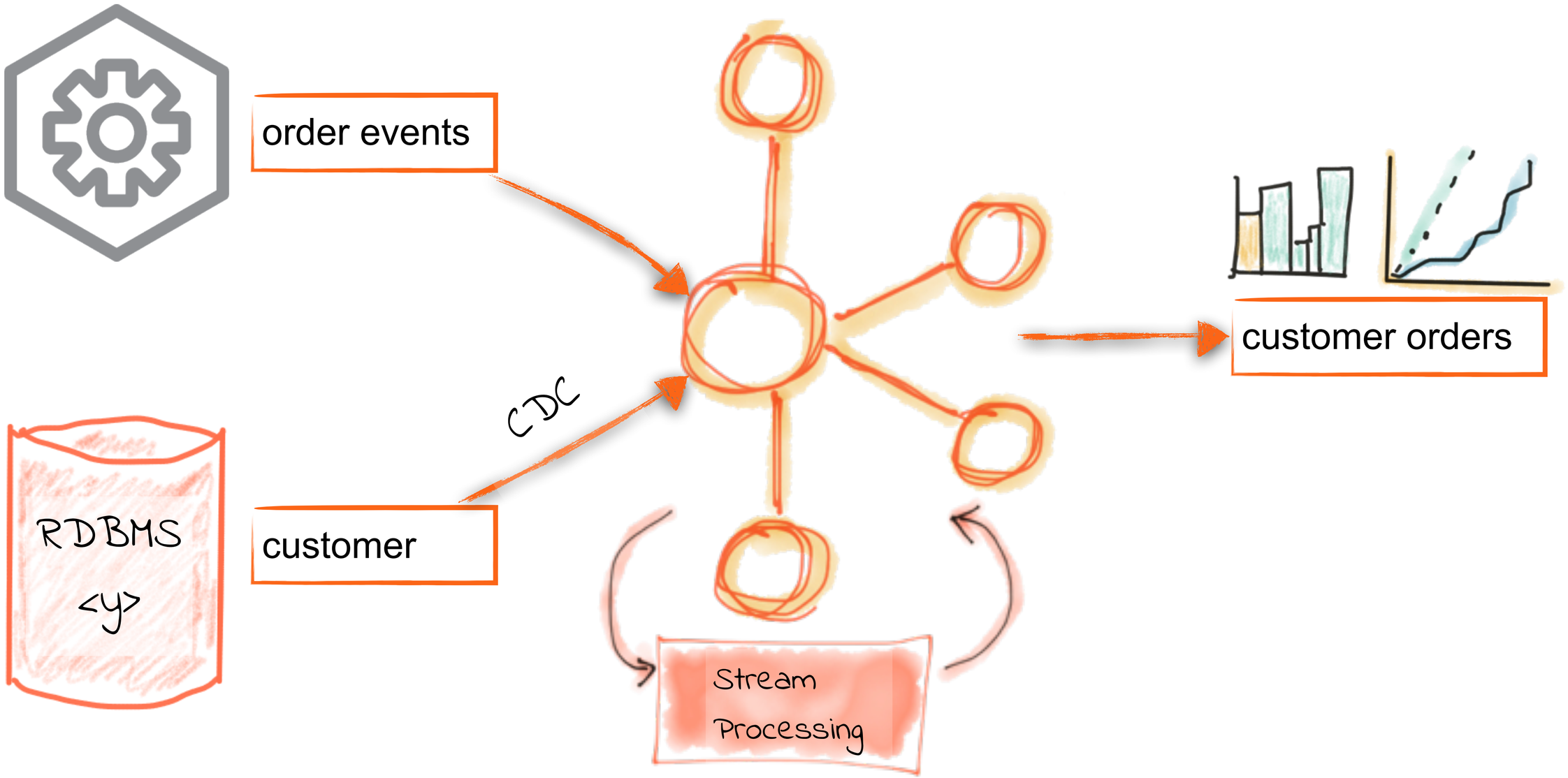
#codetalks

Photo by Emily Morter on Unsplash

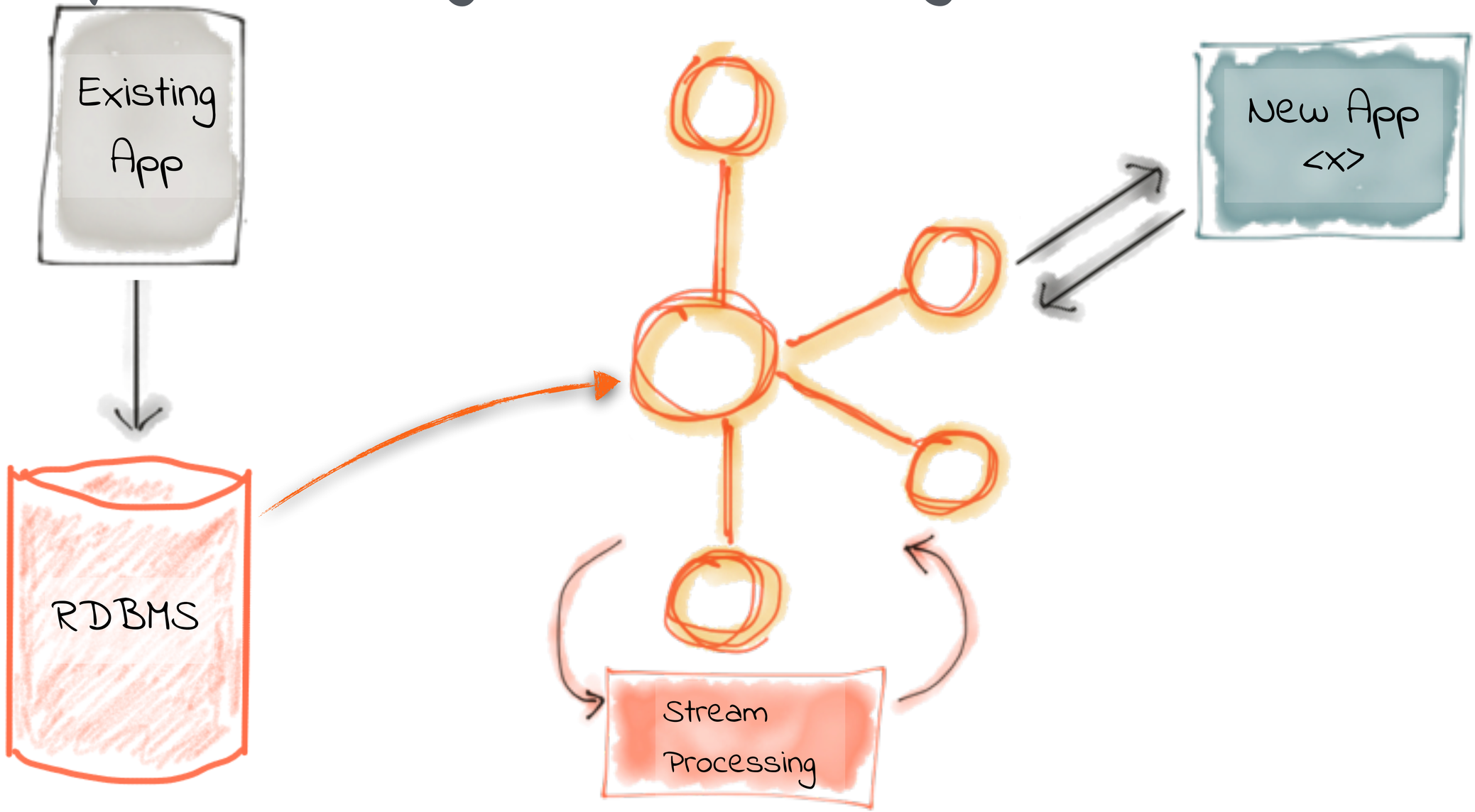
Analytics - Database Offload



Real-time Event Stream Enrichment



Evolve processing from old systems to new



"

But streaming...I've just got data in a database...right?

"

Bold claim: all your data is event streams

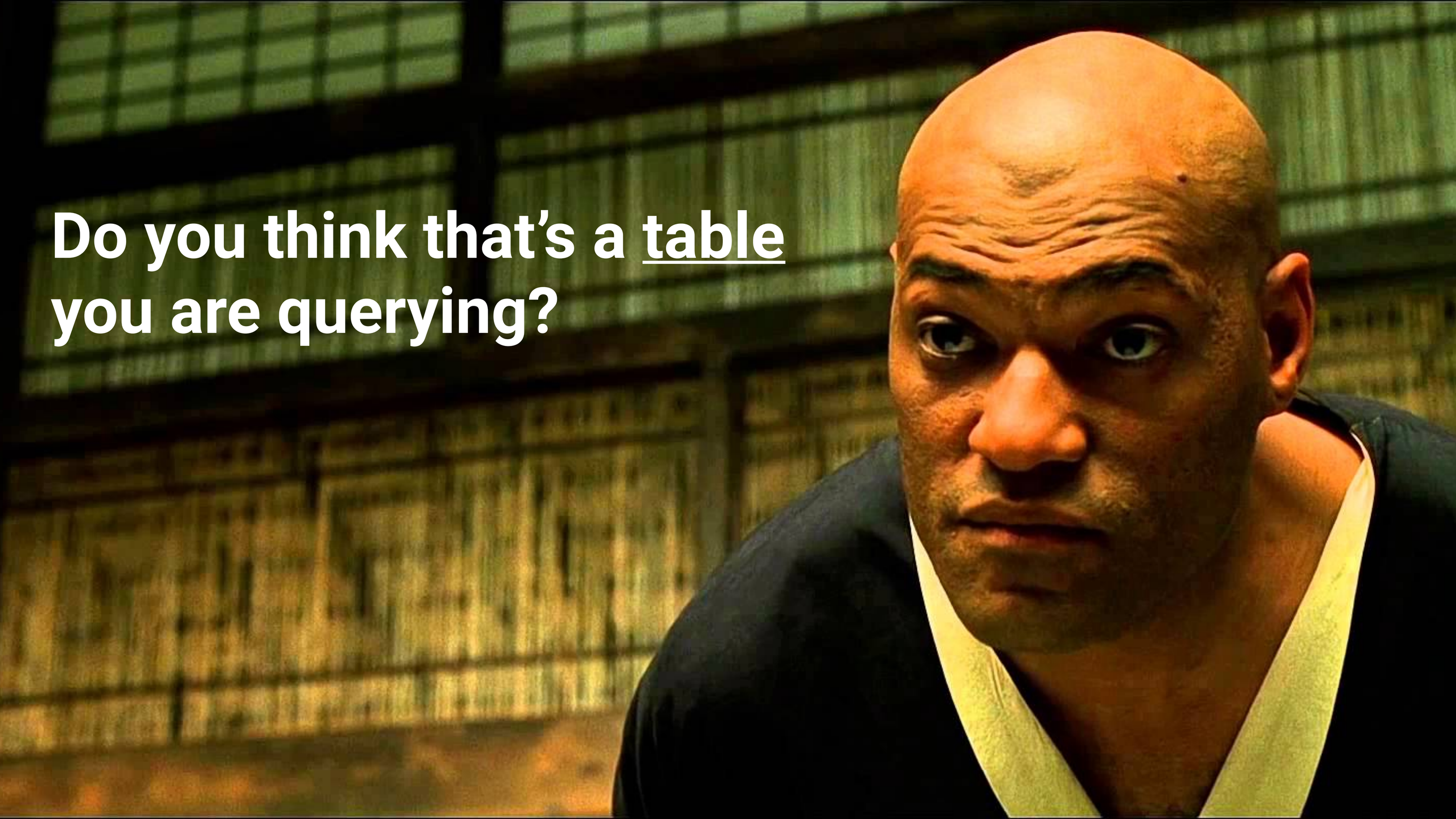
A Customer Experience

A Sale

A Sensor Reading

An Application Log Entry

Databases


Do you think that’s a table
you are querying?

The Stream Table Duality

Account ID	Balance
12345	€50

The Stream Table Duality

Account ID	Amount
12345	+ €50

Time

Account ID	Balance
12345	€50

The Stream Table Duality

Time

Account ID	Amount
12345	+ €50
12345	+ €25

Account ID	Balance
12345	€75

The Stream Table Duality

Time

Account ID	Amount
12345	+ €50
12345	+ €25
12345	-€60

Account ID	Balance
12345	€15

The Stream Table Duality

Stream

Time

Account ID	Amount
12345	+ €50
12345	+ €25
12345	-€60

Table

Account ID	Balance
12345	€15

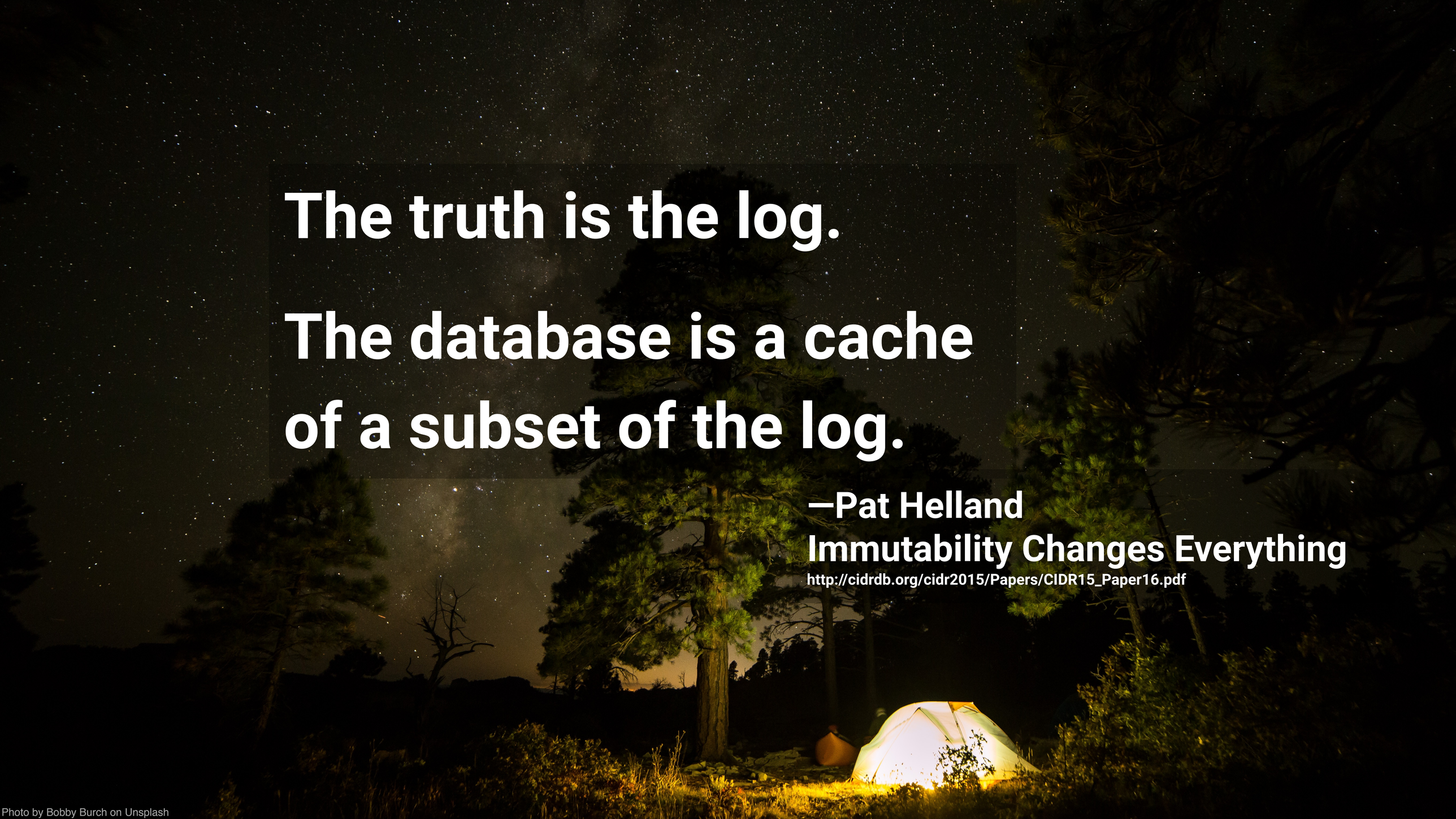


Photo by Bobby Burch on Unsplash

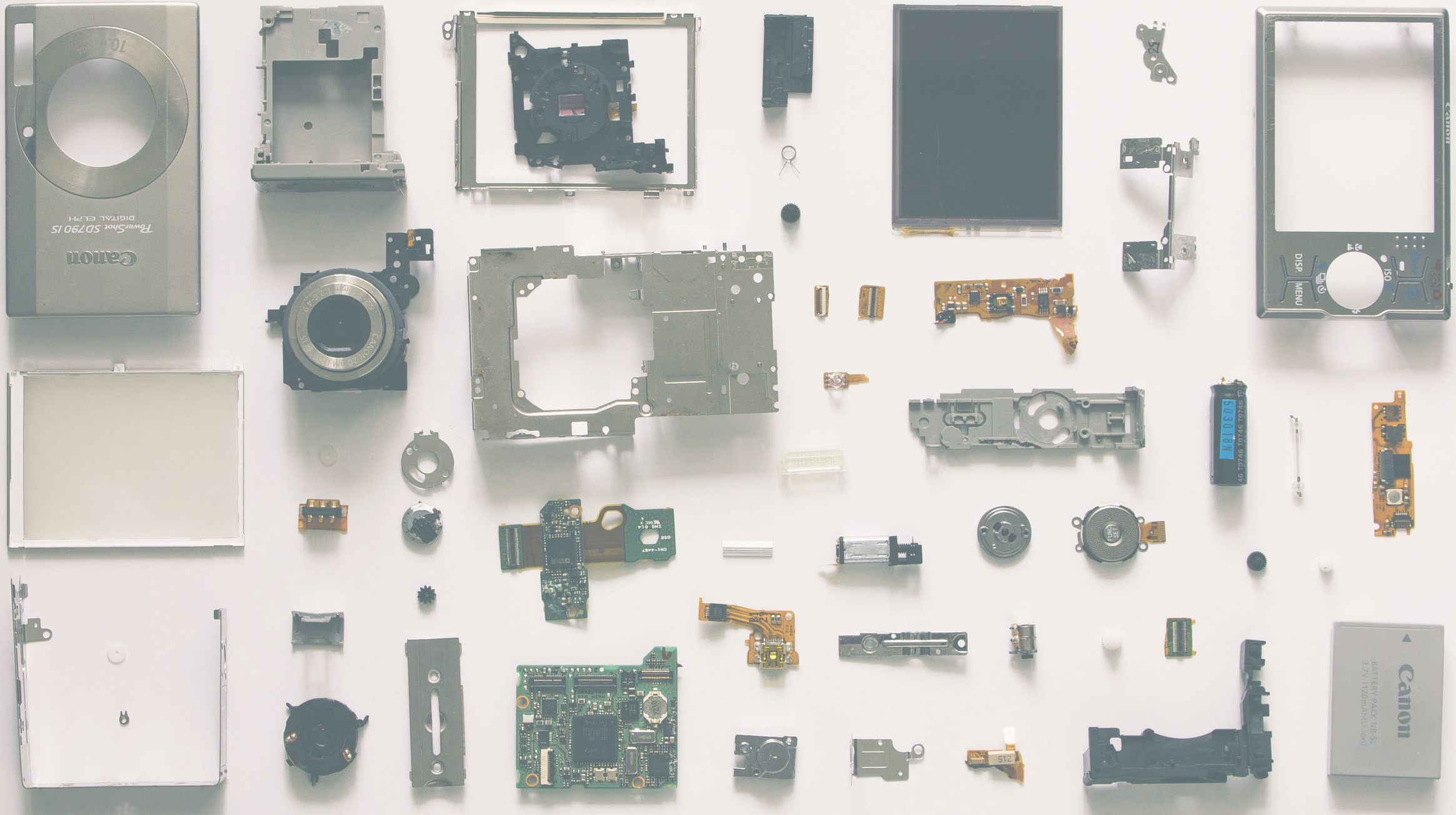
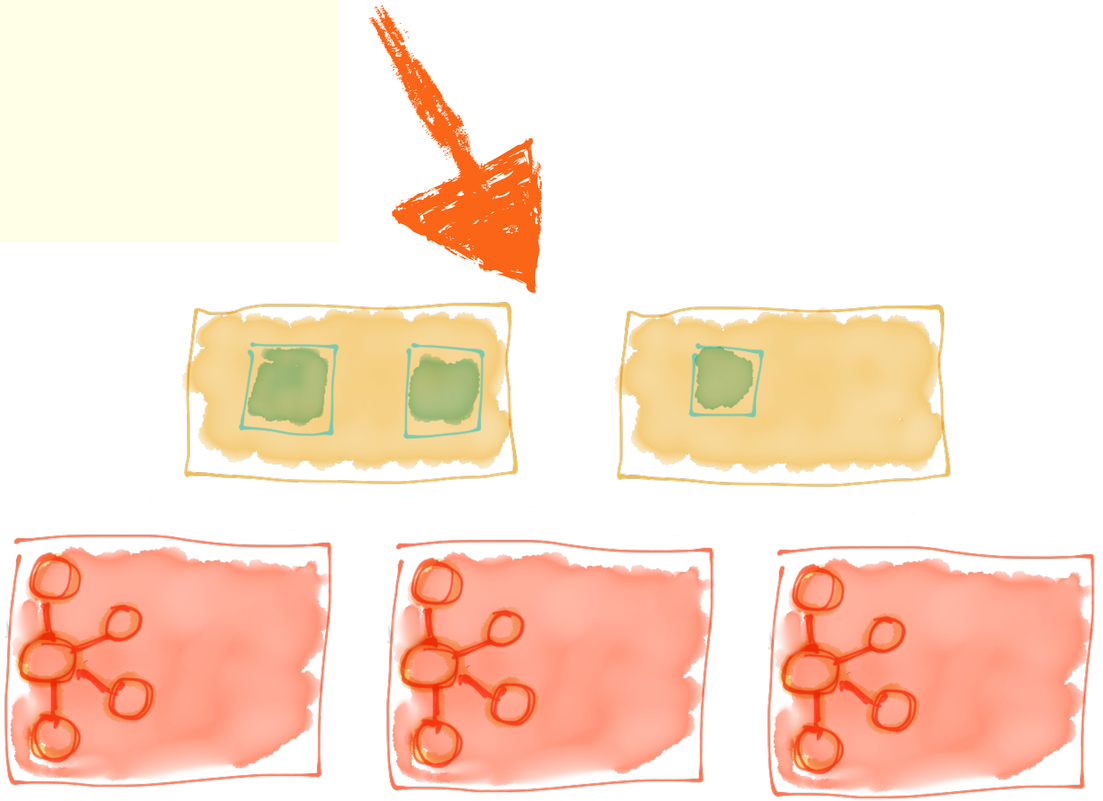


Photo by Vadim Sherbakov on Unsplash

Streaming Integration with Kafka Connect

Sources

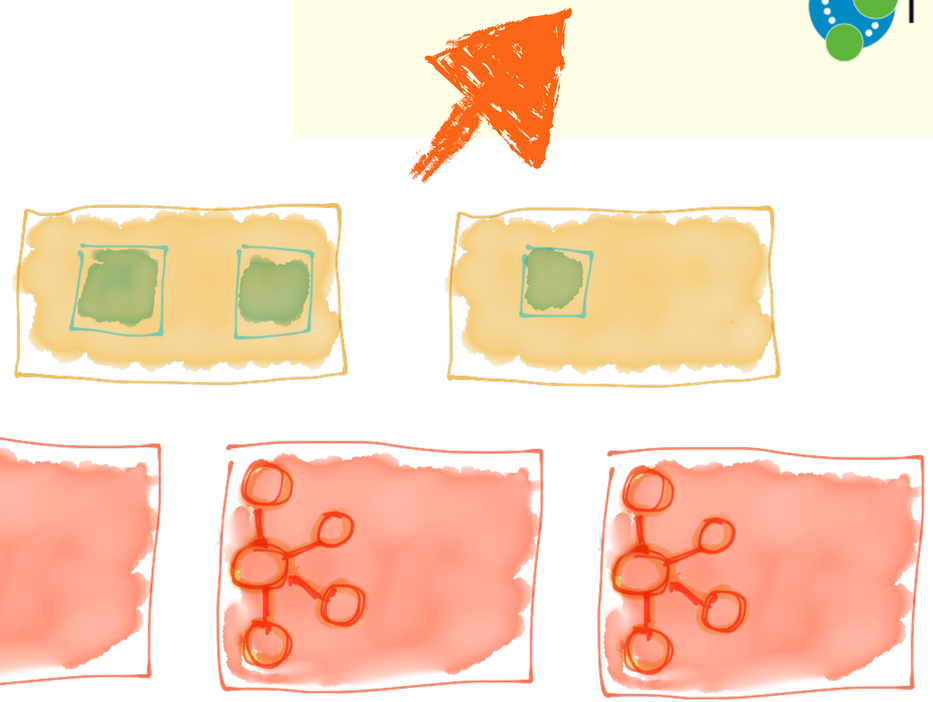


Kafka Connect

Kafka Brokers

Streaming Integration with Kafka Connect

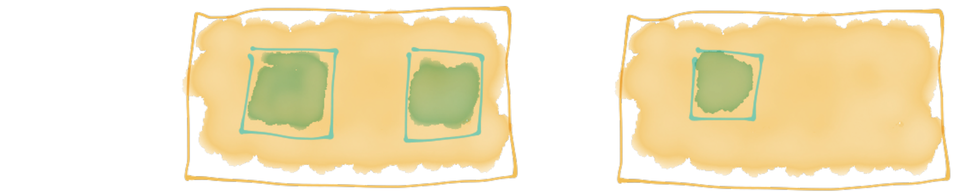
Sinks



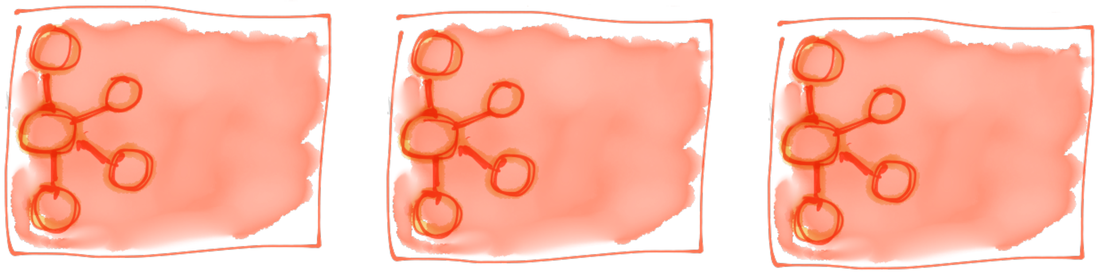
Kafka Connect

Kafka Brokers

Streaming Integration with Kafka Connect



Kafka Connect



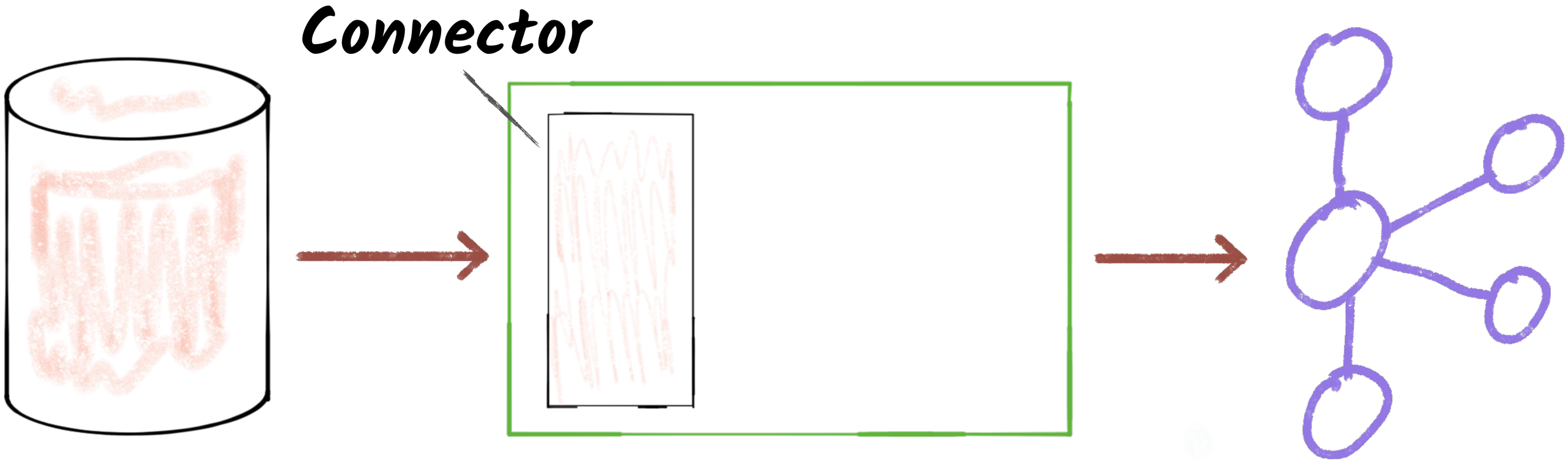
Kafka Brokers

Look Ma, No Code!

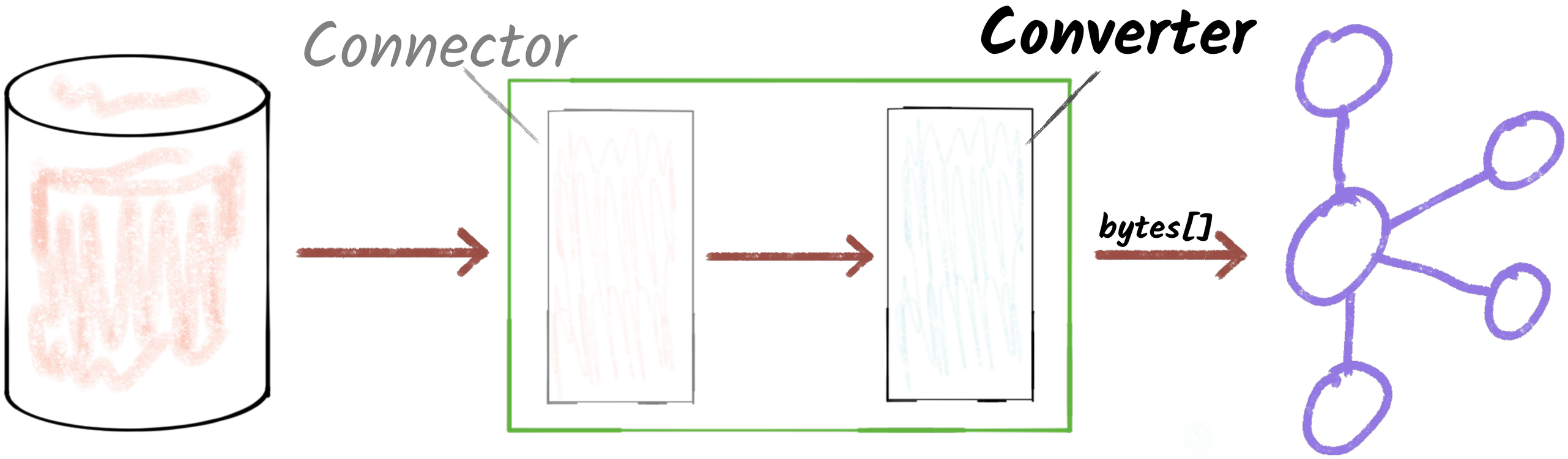
```
{
  "connector.class":
    "io.confluent.connect.jdbc.JdbcSourceConnector",
  "connection.url":
    "jdbc:mysql://asgard:3306/demo",
  "table.whitelist":
    "sales,orders,customers"
}
```

Kafka Connect basics

Connectors



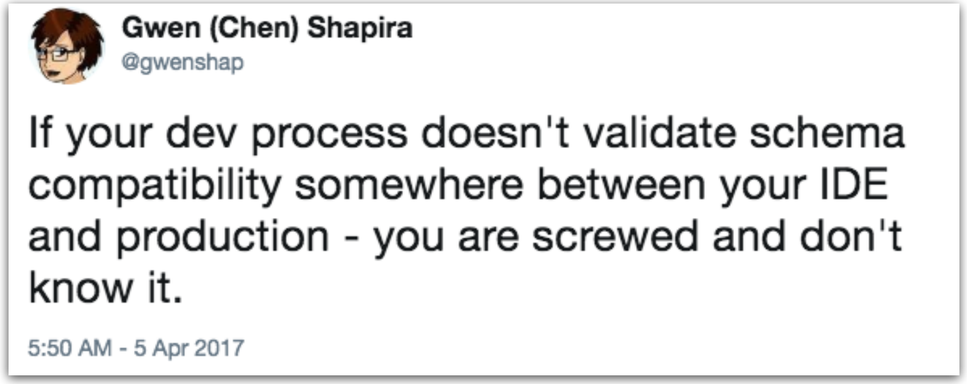
Converters



Serialisation & Schemas

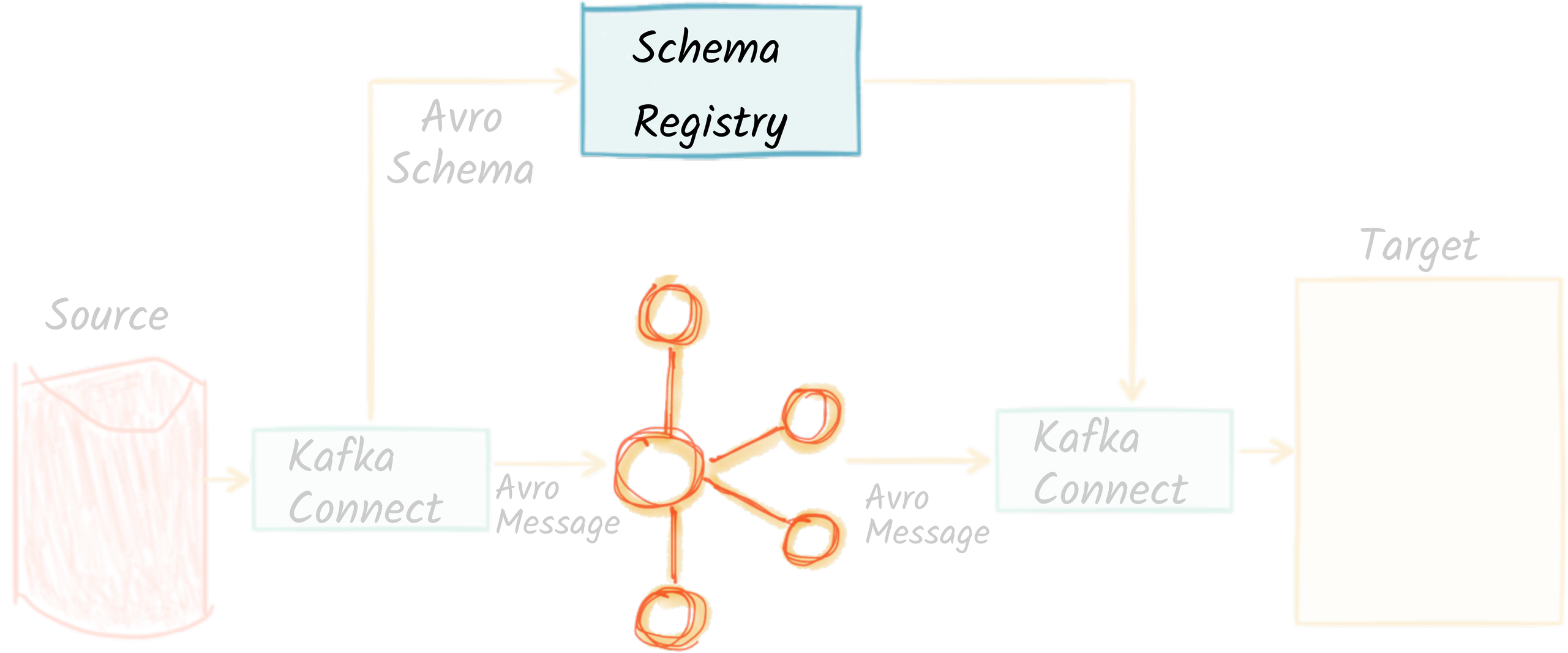
Avro Protobuf JSON CSV

-> Confluent Schema Registry

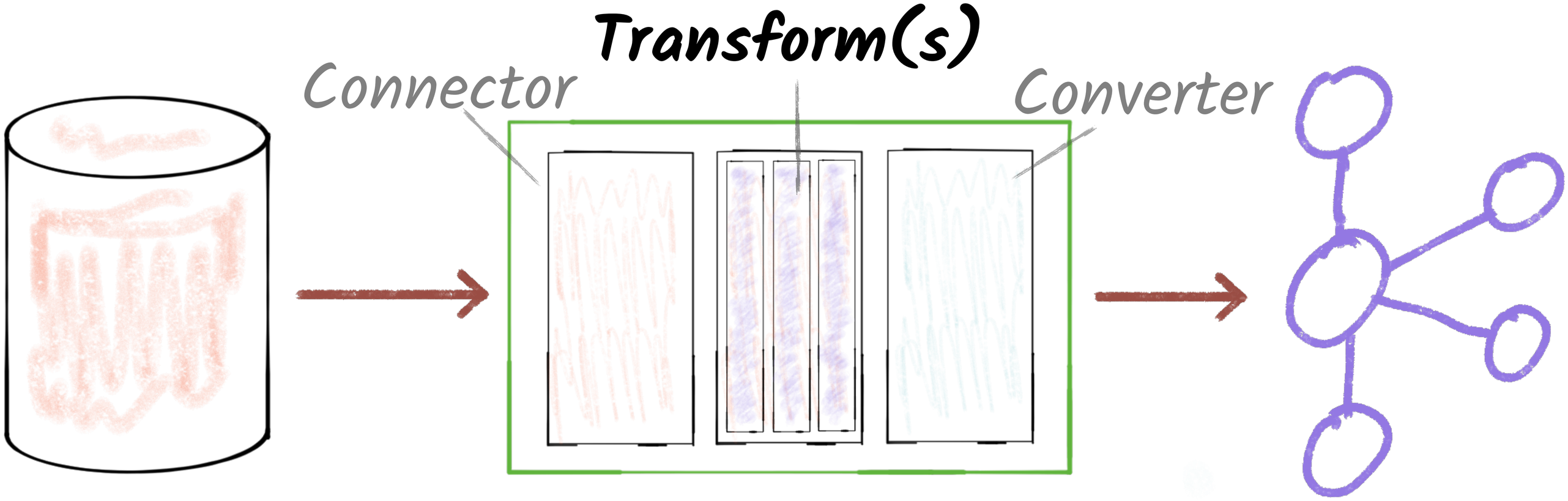


https://qconnewyork.com/system/files/presentation-slides/qcon_17_-_schemas_and_apis.pdf

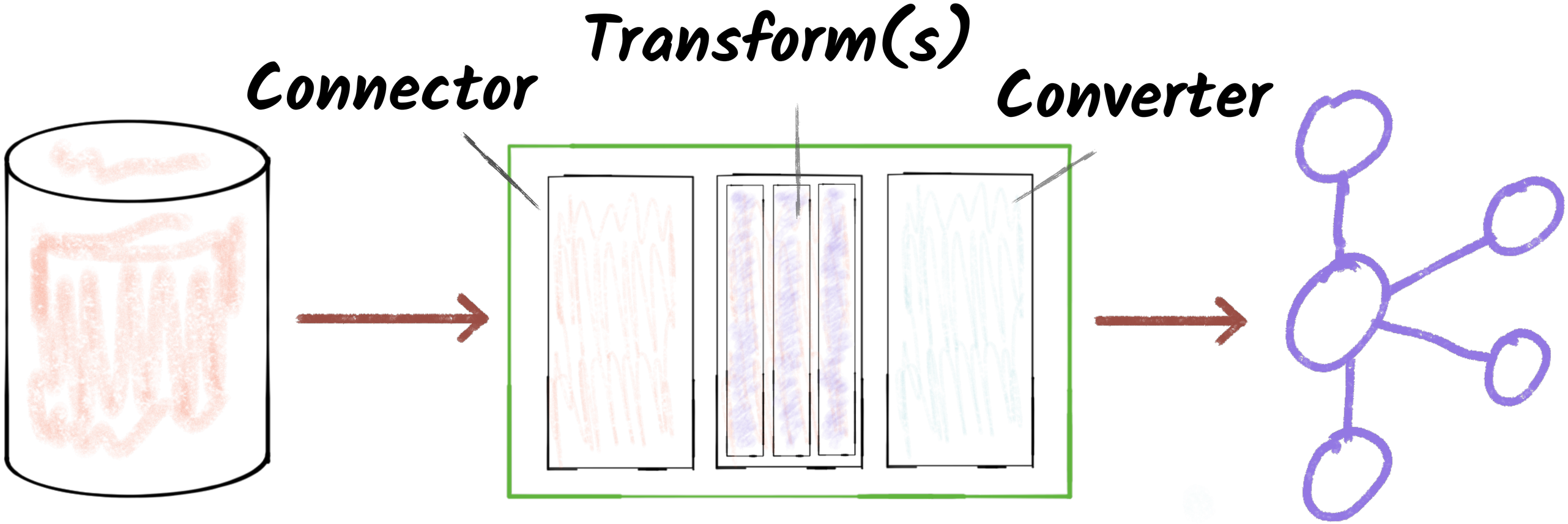
The Confluent Schema Registry



Single Message Transforms

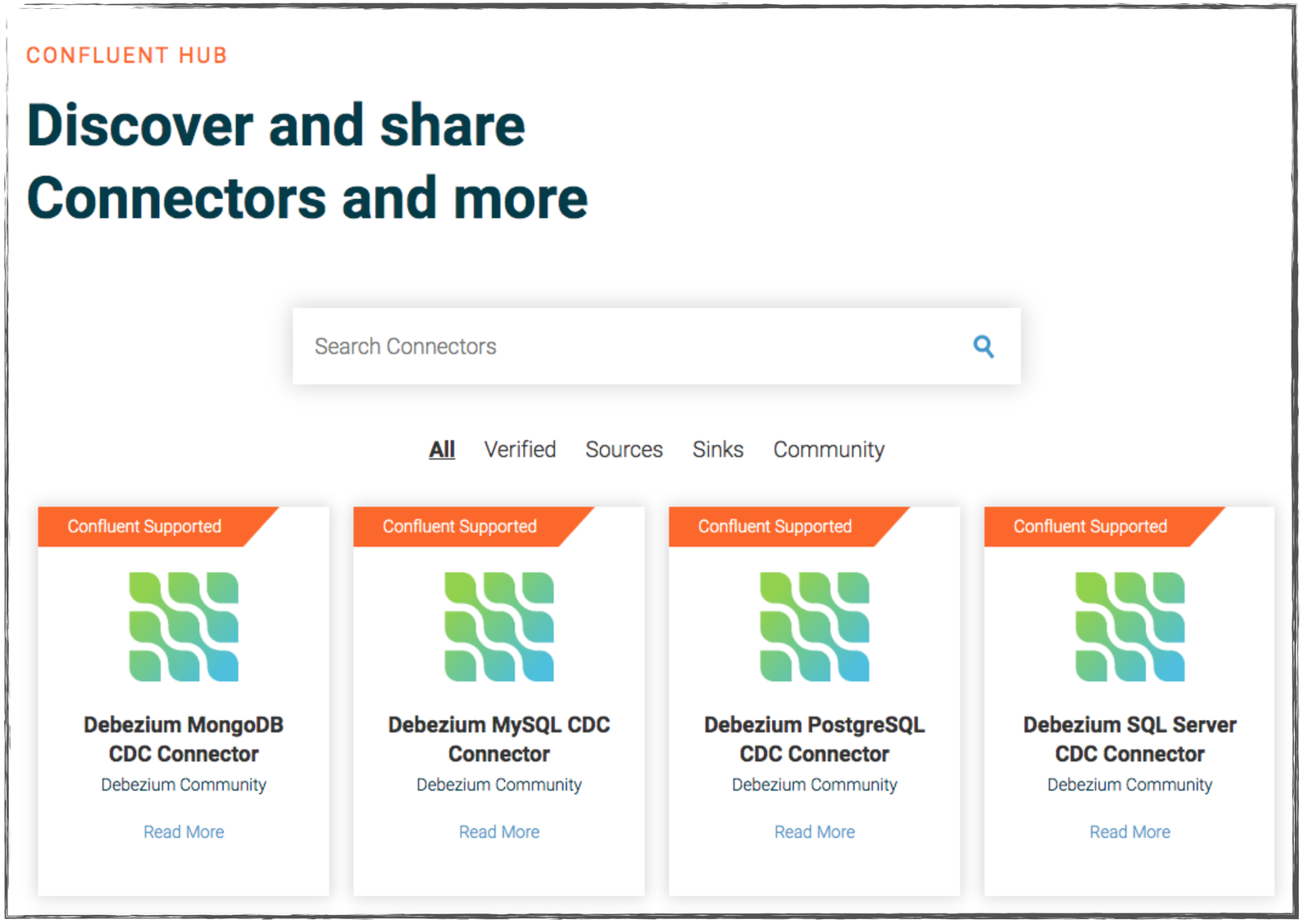


Extensible



https://kafka.apache.org/23/javadoc/

Confluent Hub

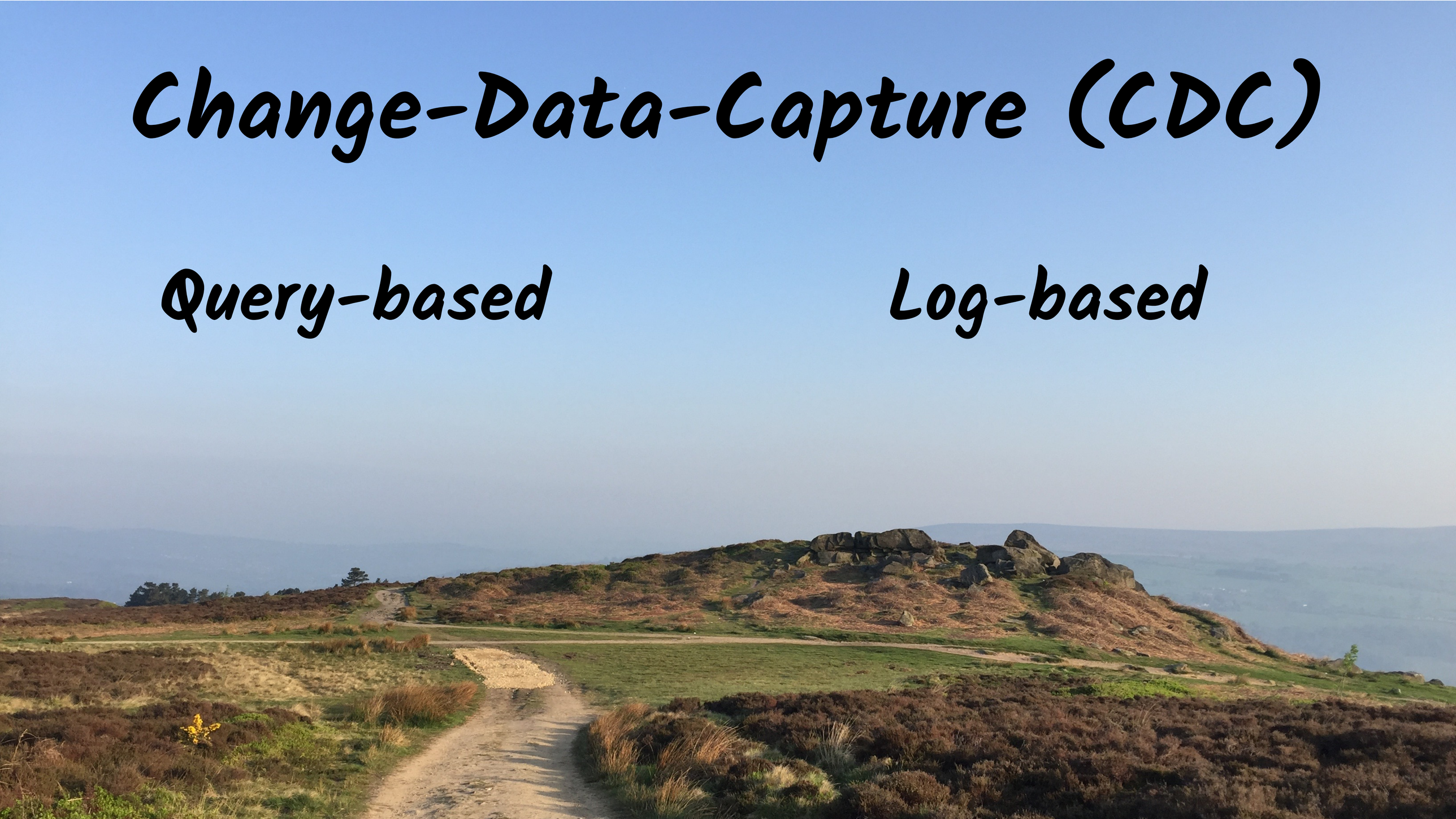


hub.confluent.io

Change-Data-Capture (CDC)

Query-based

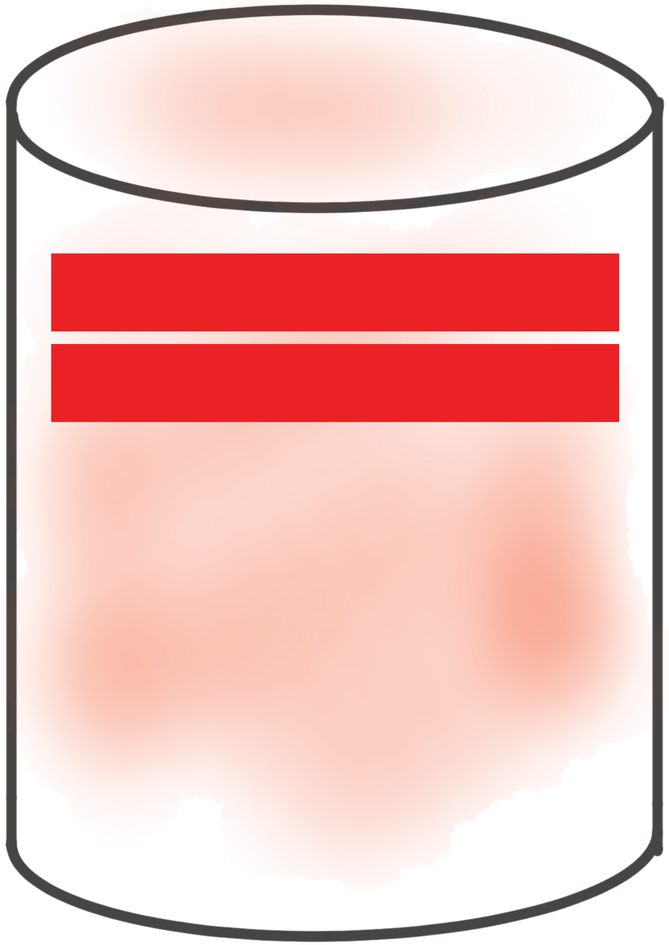
Log-based



Query-based CDC

```
SELECT *
FROM   my_table
WHERE  ts_col > previous ts
```

Query-based CDC



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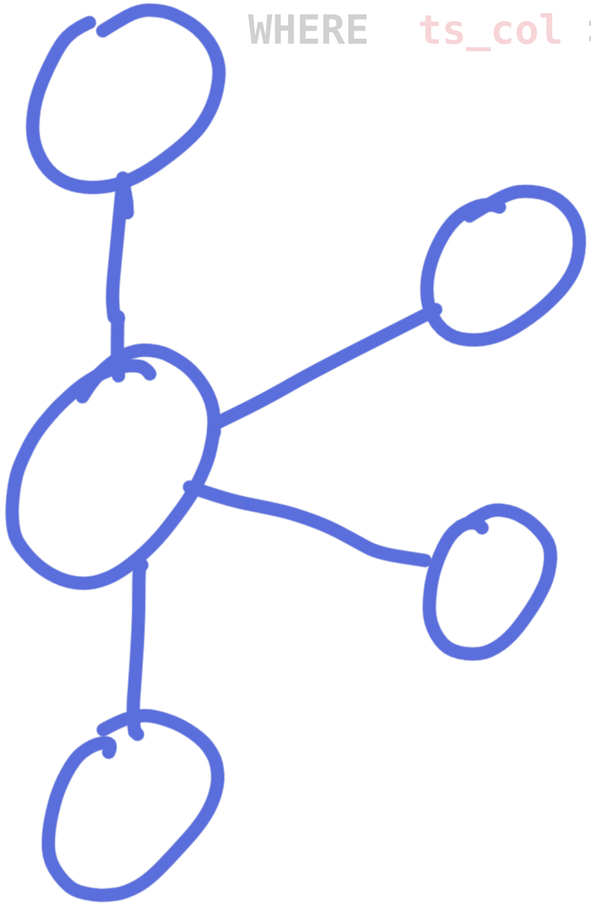
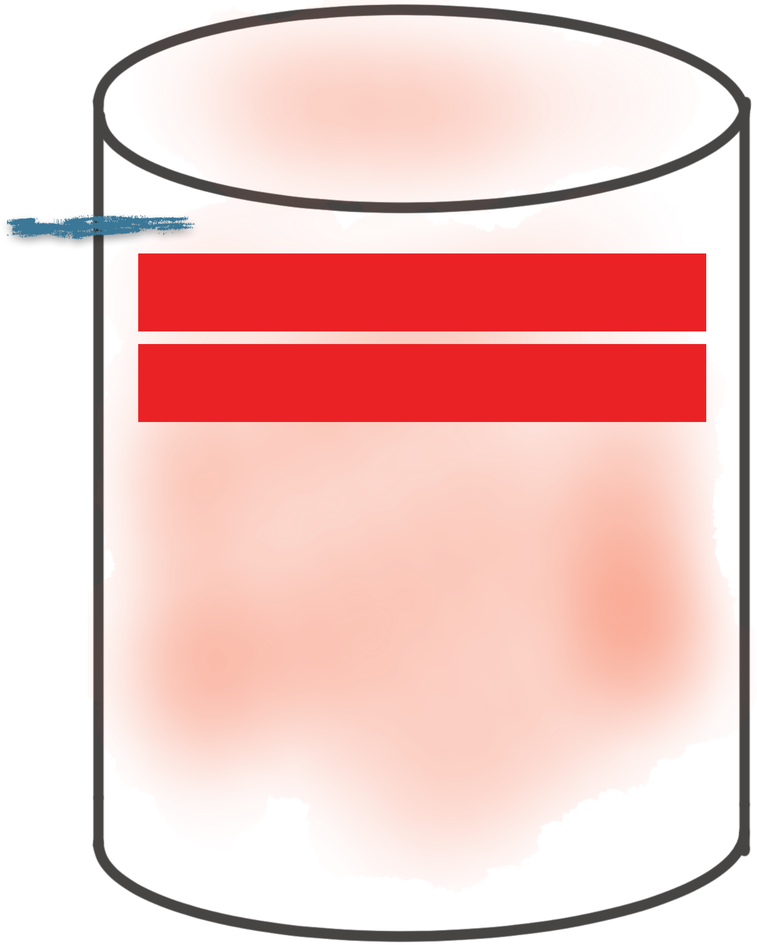


Query-based CDC



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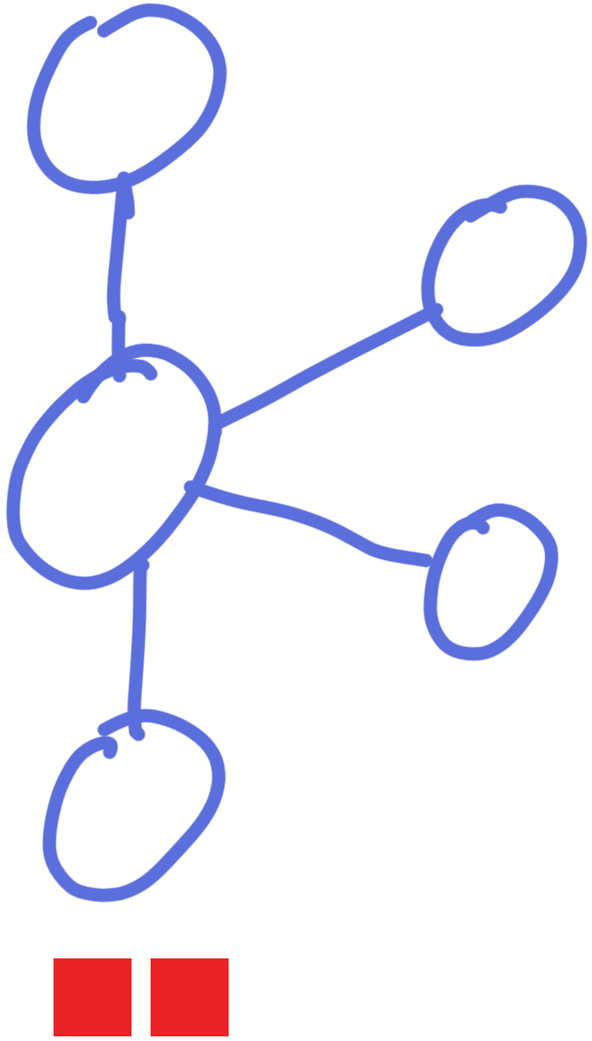
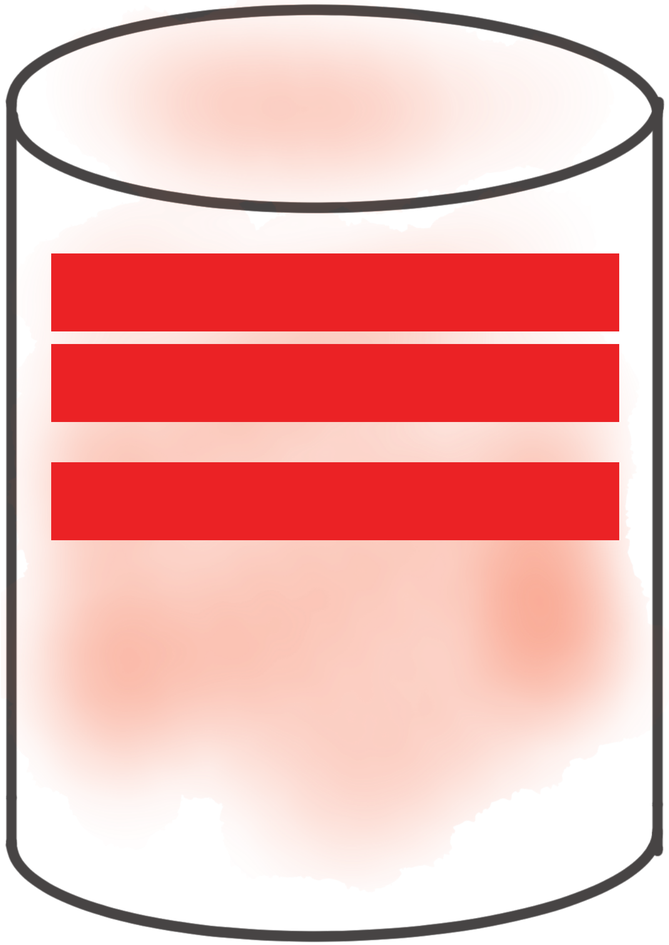


Query-based CDC



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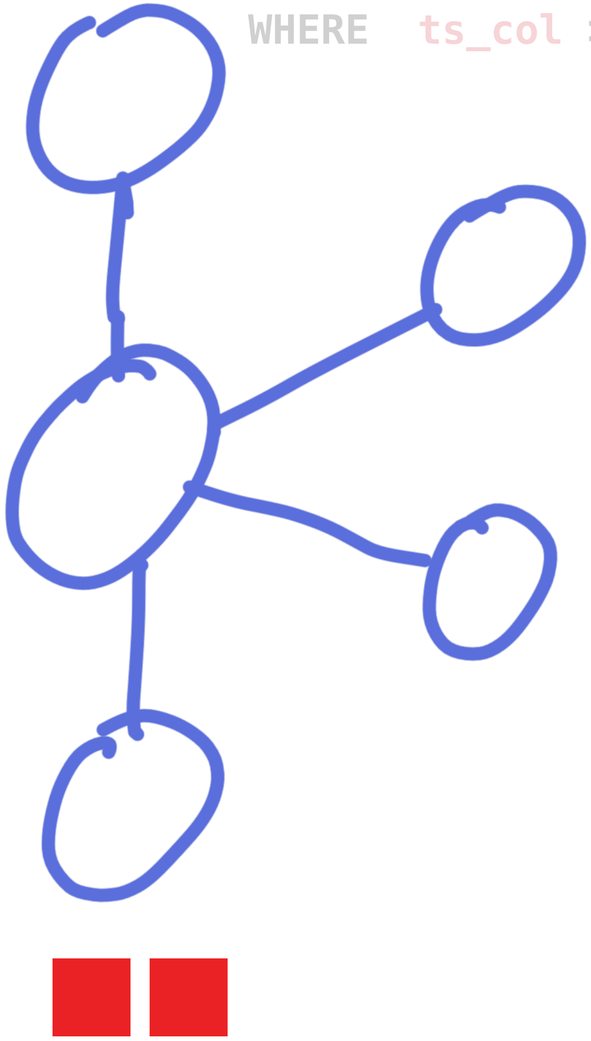

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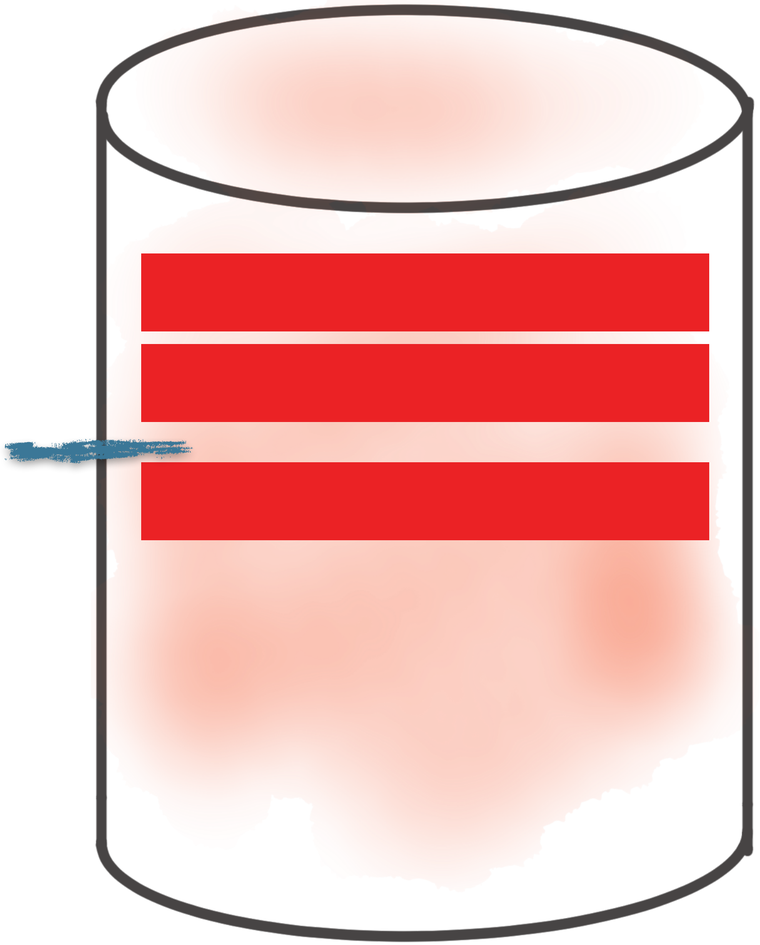

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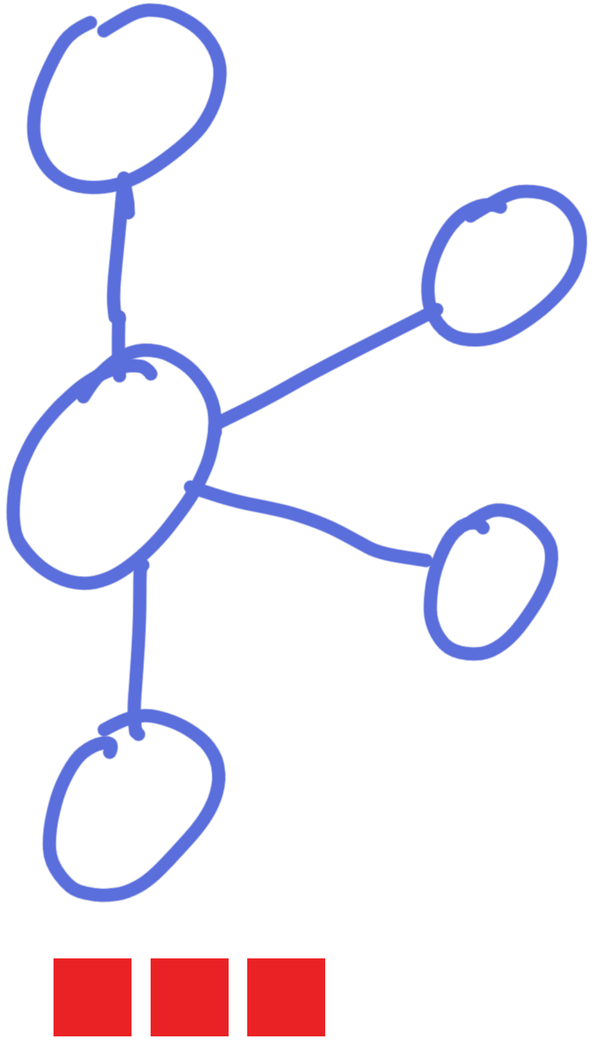
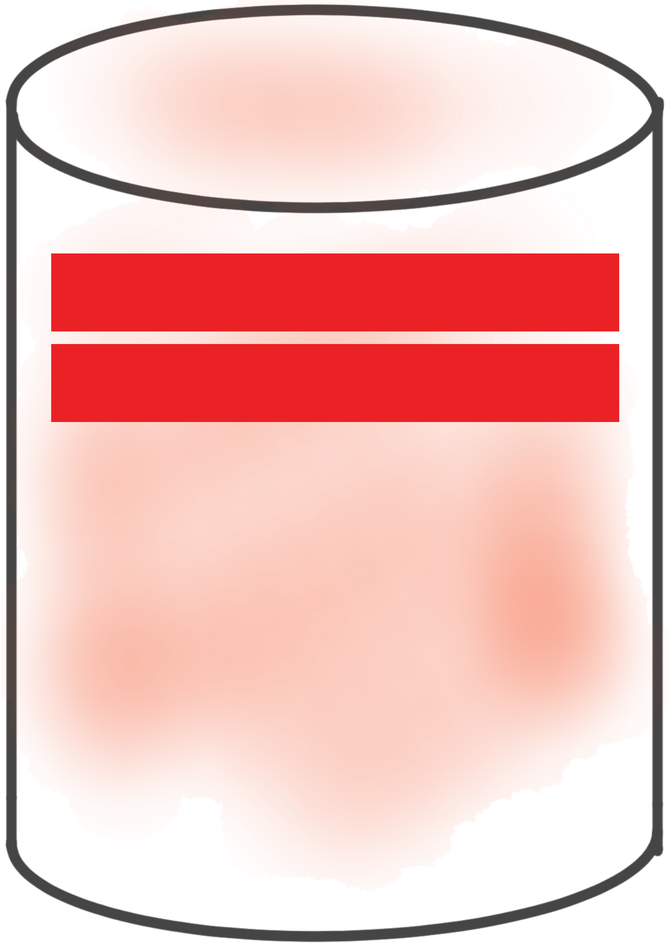
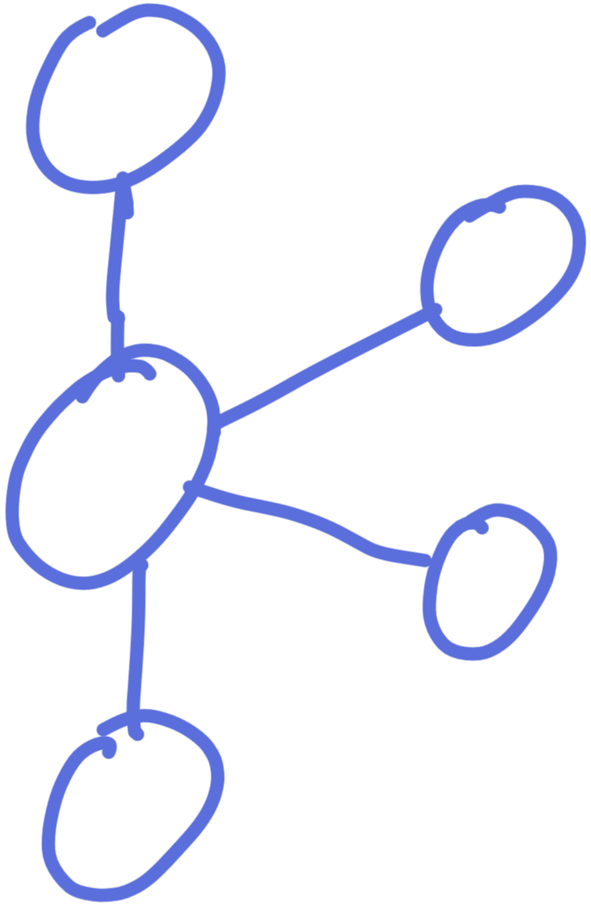


Log-based CDC

```
#051024 17:24:13 server id 1  end_log_pos 98
# Position  Timestamp   Type   Master ID        Size      Master Pos    Flags
# 00000004 9d fc 5c 43   0f   01 00 00 00   5e 00 00 00   62 00 00 00   00 00
# 00000017 04 00 35 2e 30 2e 31 35  2d 64 65 62 75 67 2d 6c |..5.0.15.debug.l|
# 00000027 6f 67 00 00 00 00 00 00  00 00 00 00 00 00 00 00 |og..............|
# 00000037 00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 |................|
# 00000047 00 00 00 00 9d fc 5c 43  13 38 0d 00 08 00 12 00 |.......C.8......|
# 00000057 04 04 04 04 12 00 00 4b  00 04 1a               |.......K...|
```

Log-based CDC

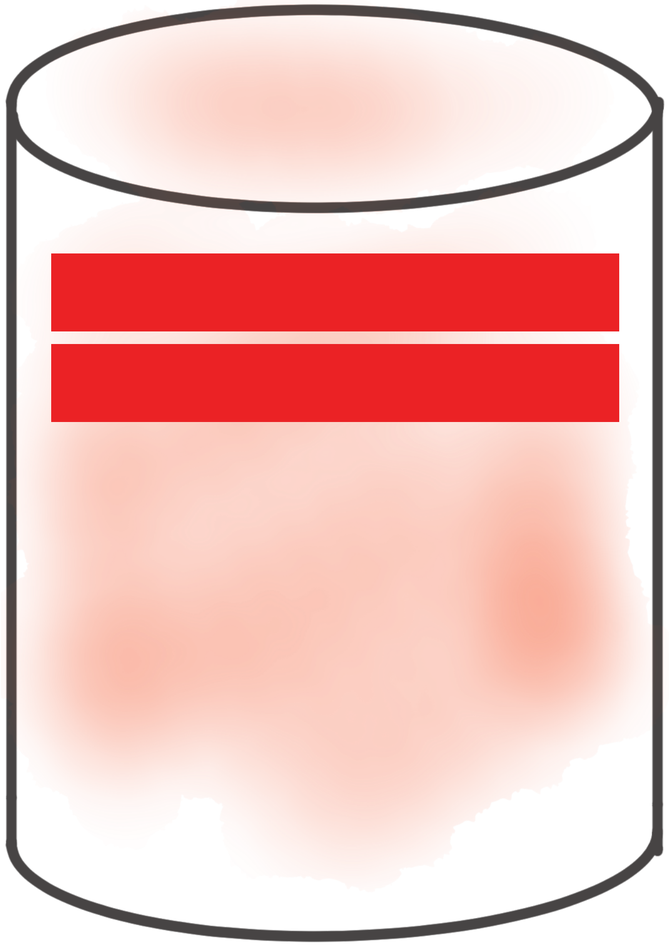


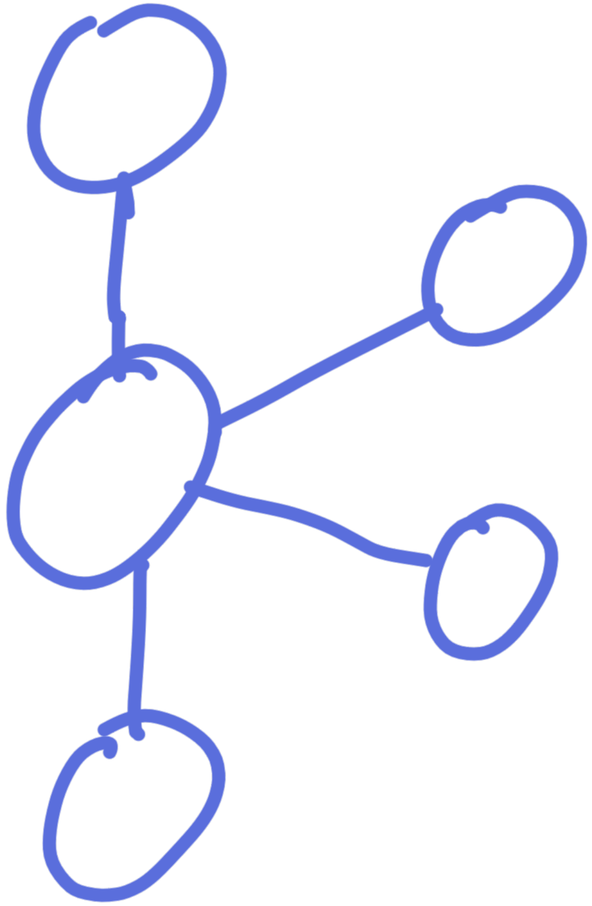


Transaction log

confluent

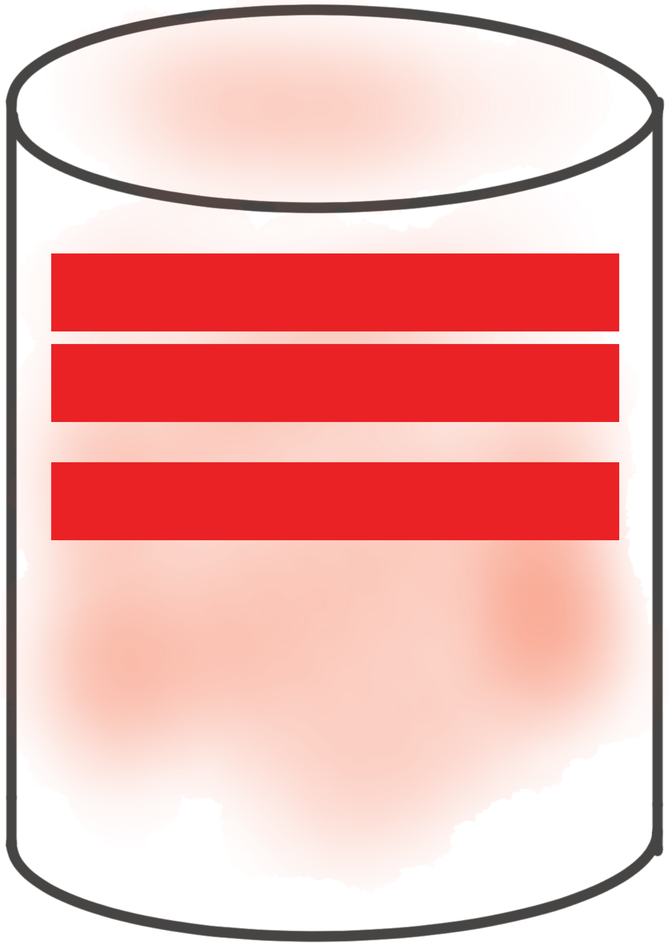
Log-based CDC

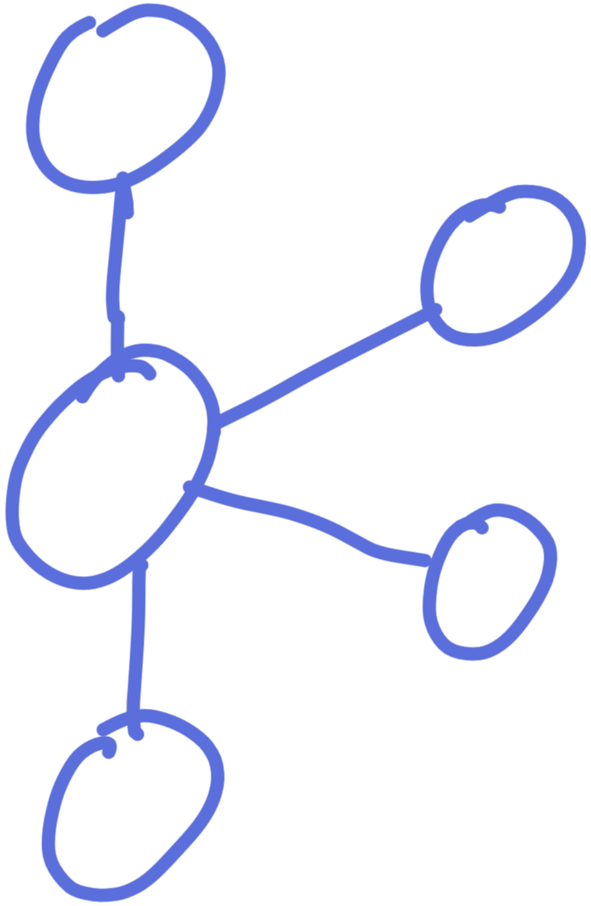




Transaction log

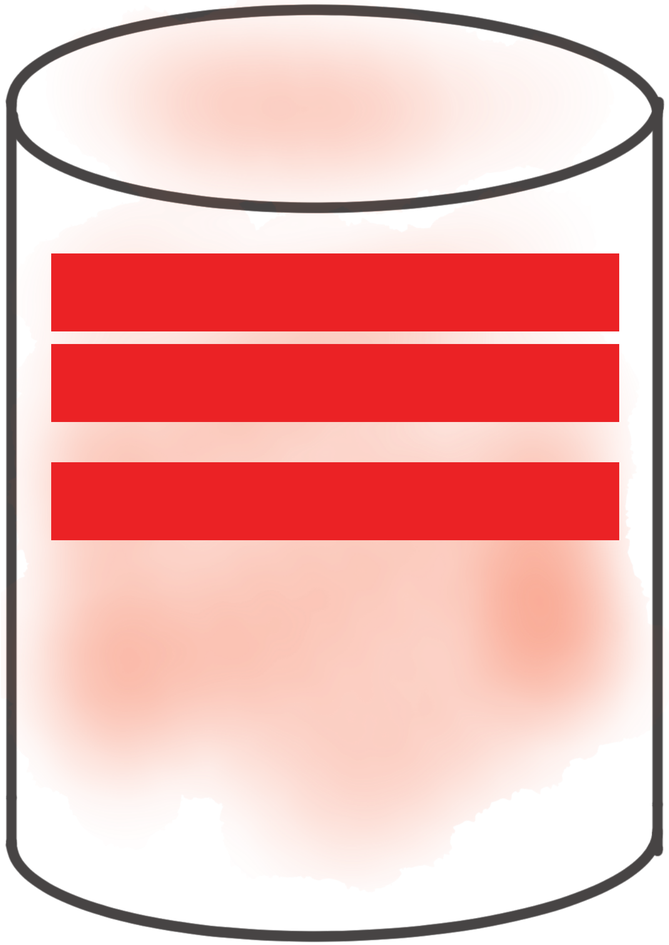
Log-based CDC

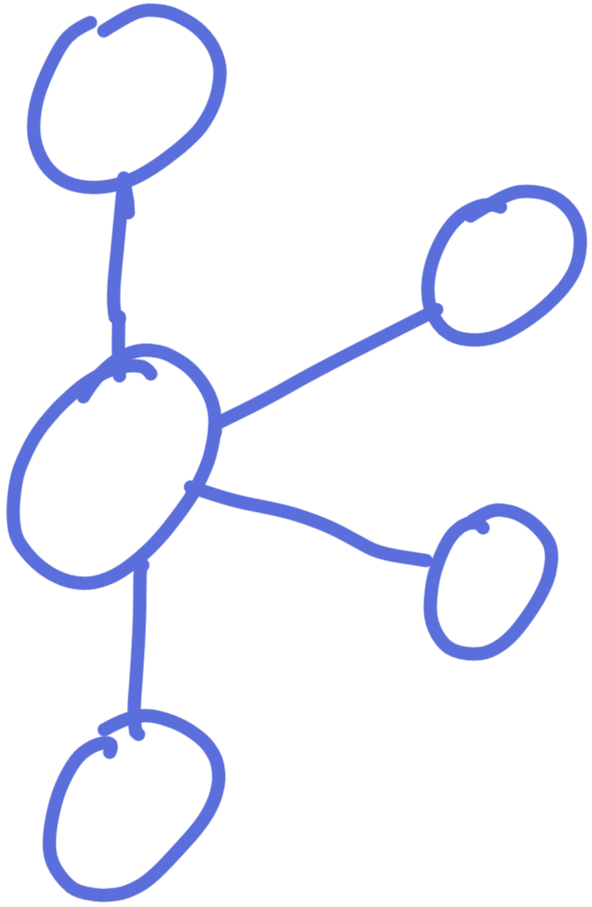




Transaction log

Log-based CDC





Transaction log

Demo Time!

https://rmoff.dev/codetalks19-code

Query-based CDC
Log-based CDC
imgflip.com
JAKE-CLARK.TUMBLR

Query-based CDC

- ✅ Usually easier to setup
- ✅ Requires fewer permissions
- 🛑 Needs specific columns in source schema to track changes
- 🛑 Impact of polling the DB (or higher latencies tradeoff)
- 🛑 Can't track deletes
- 🛑 Can't track multiple events between polling interval

Photo by Matese Fields on Unsplash

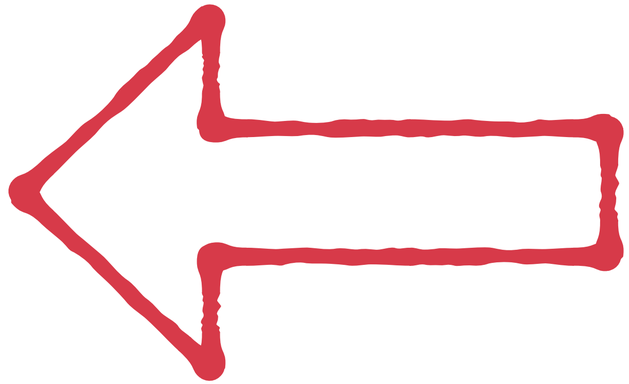
Query-based CDC

```
SELECT *
FROM   my_table
WHERE  ts_col > previous ts
```

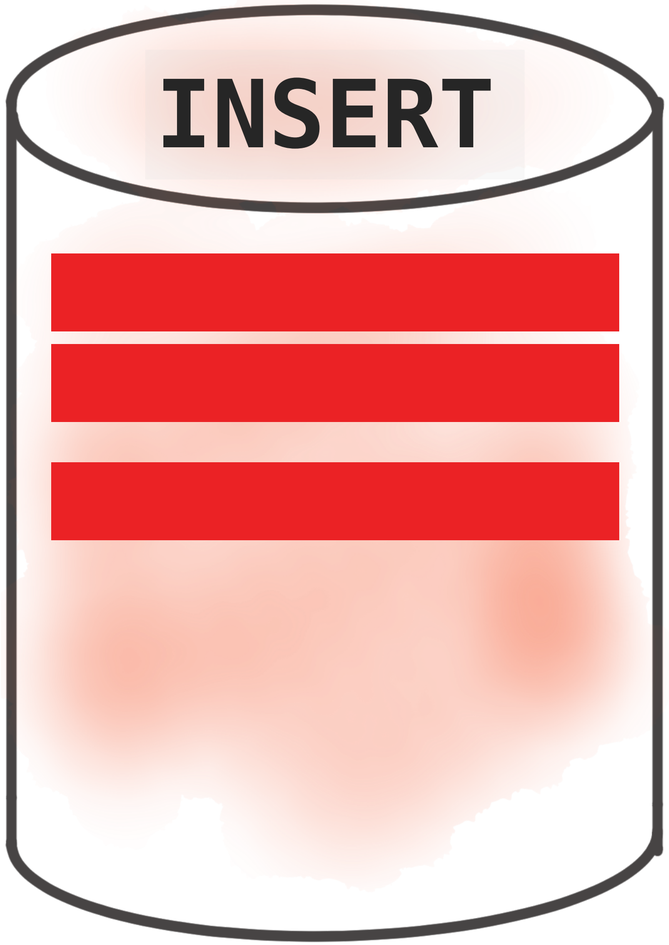
Query-based CDC

```
CREATE TABLE my_table (
    ID INT,
    FOO VARCHAR,
    BAR VARCHAR,
    WIBBLE VARCHAR,
    TS_COL TIMESTAMP
      DEFAULT CURRENT_TIMESTAMP
      ON UPDATE CURRENT_TIMESTAMP
)
```

```
SELECT *
FROM   my_table
WHERE  ts_col > previous ts
```



Query-based CDC

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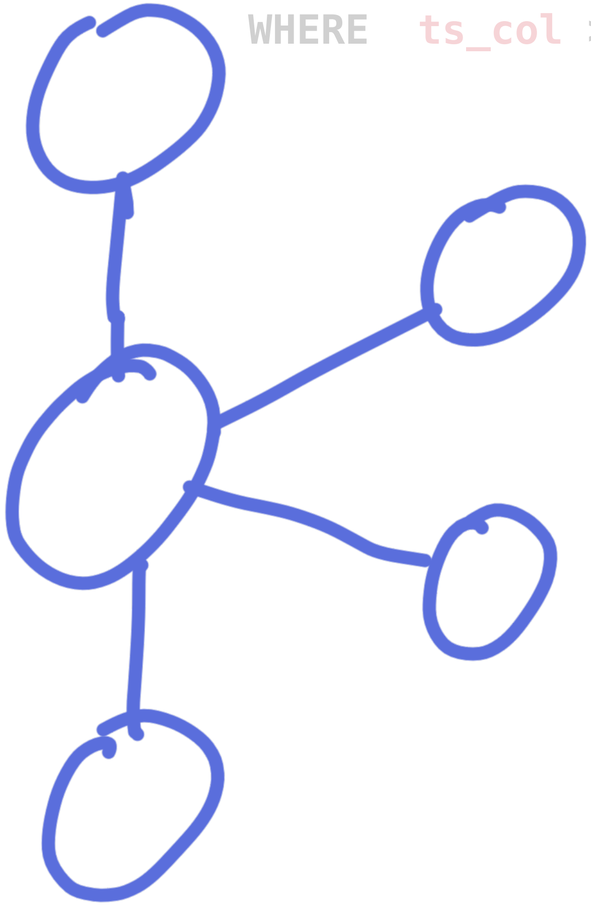

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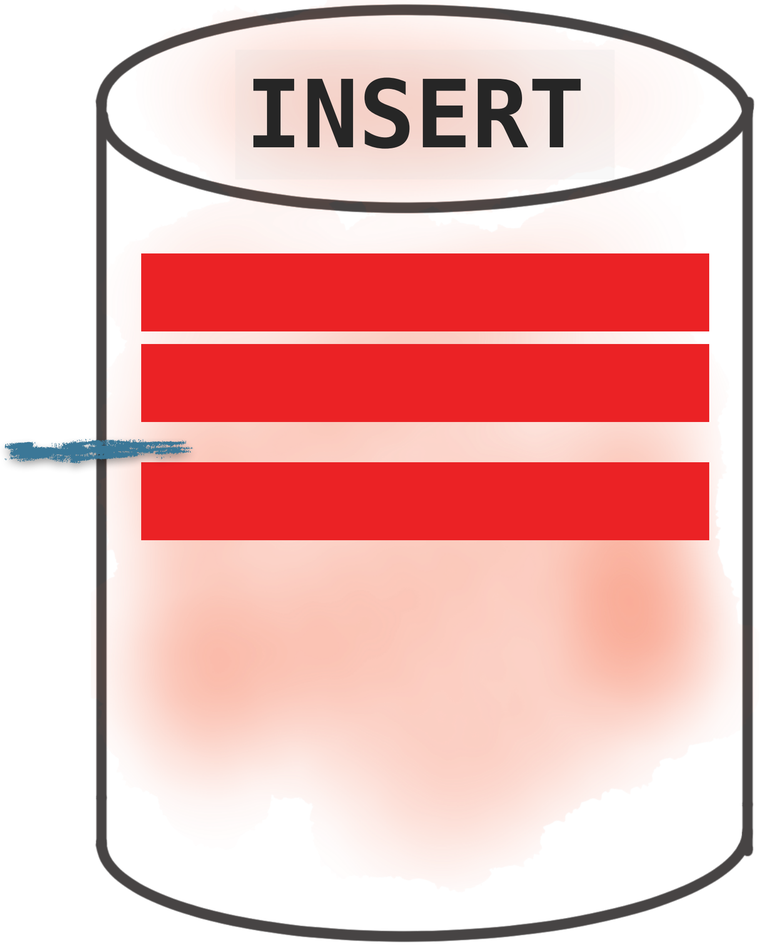


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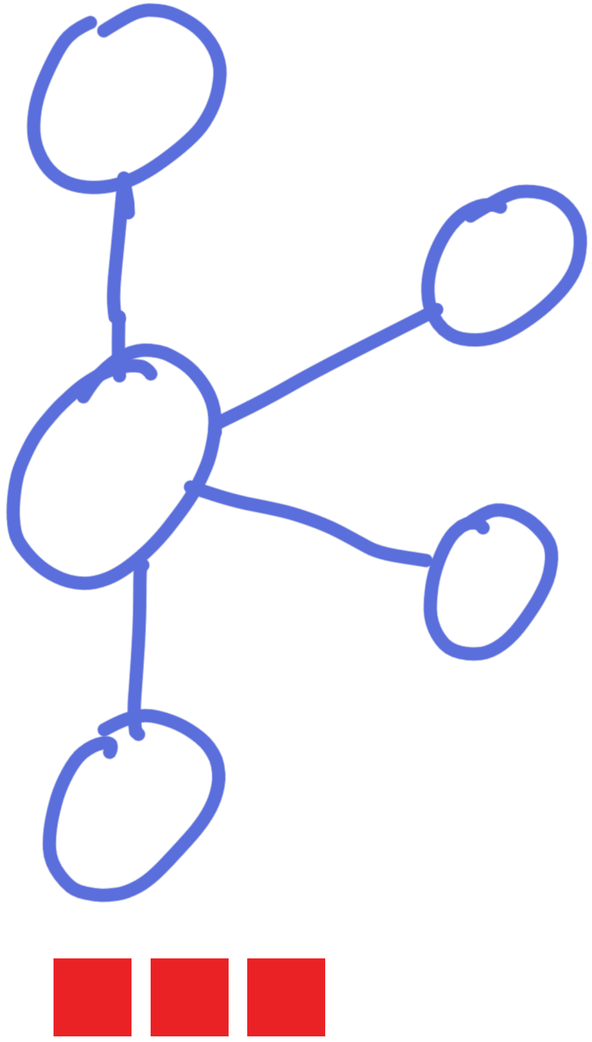
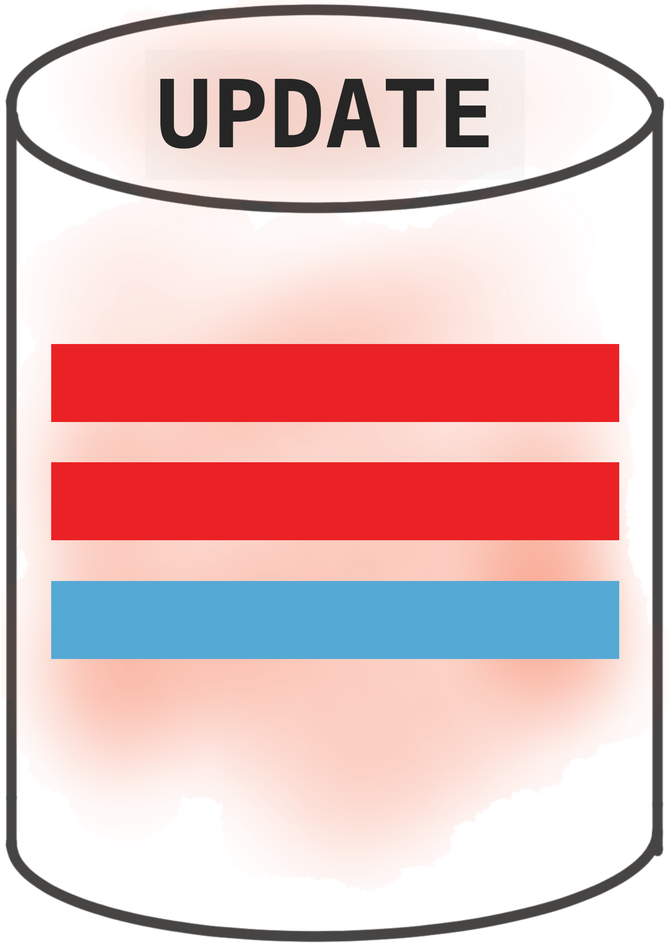
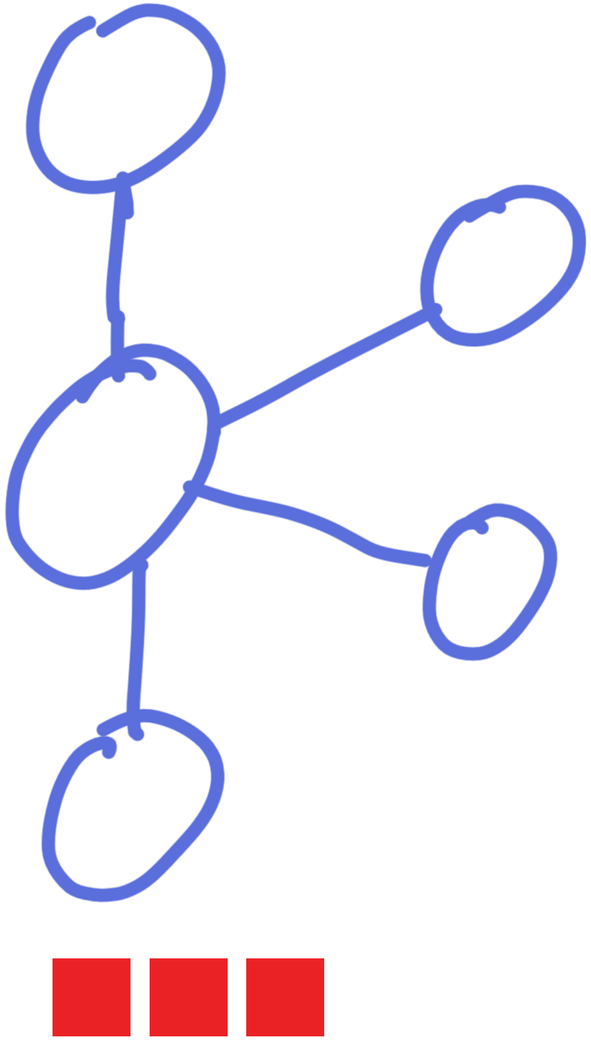


Query-based CDC





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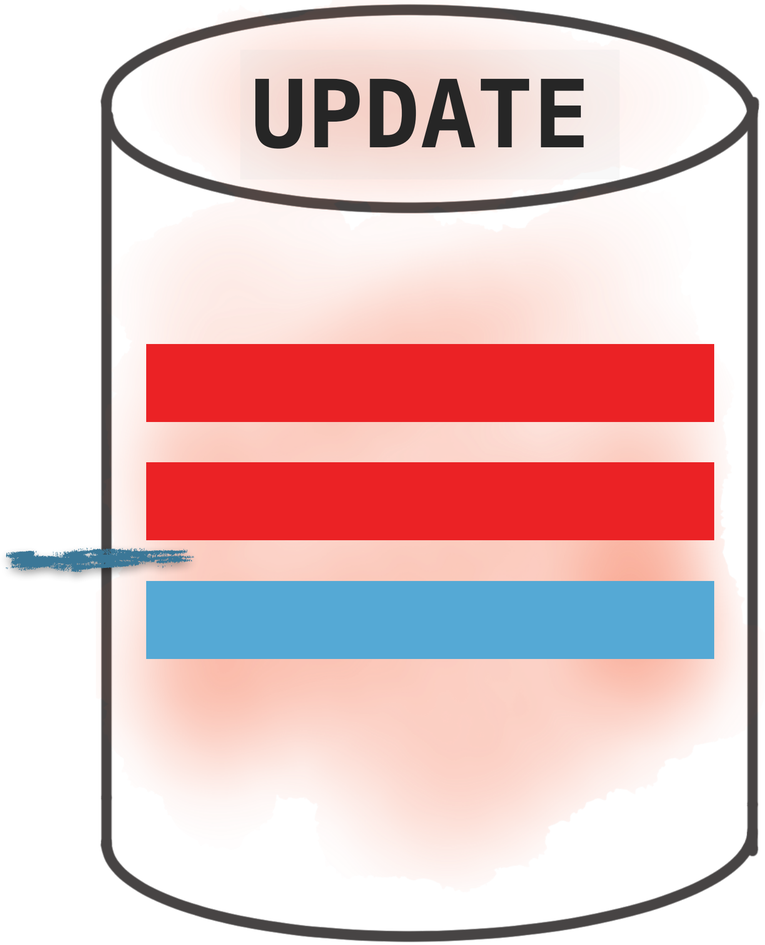


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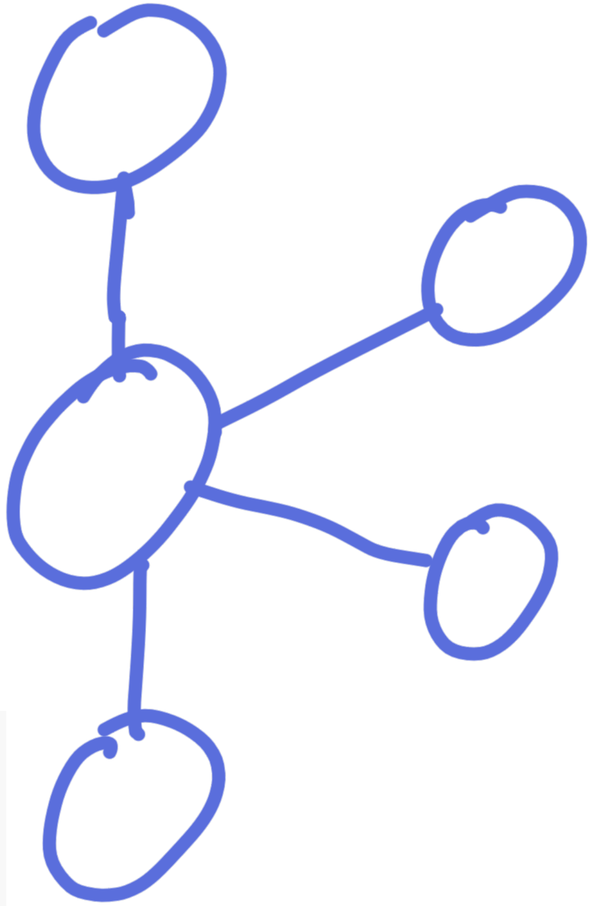
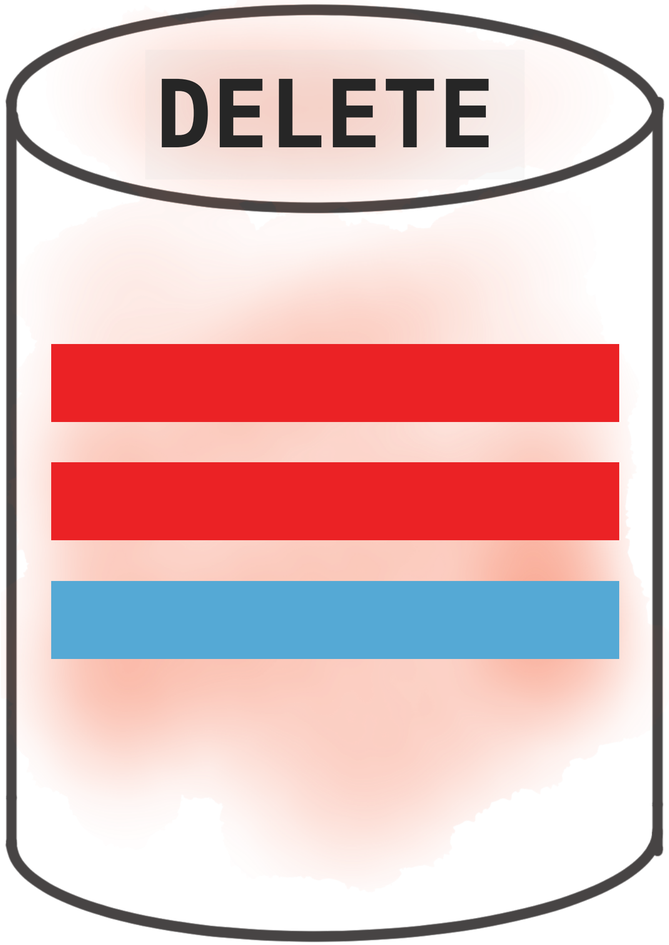
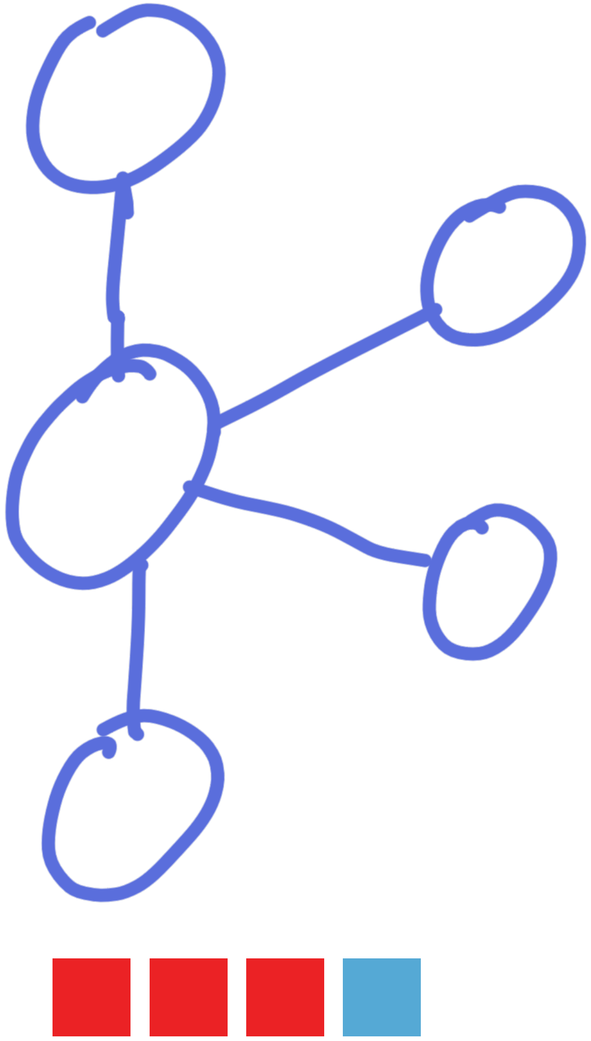


Query-based CDC





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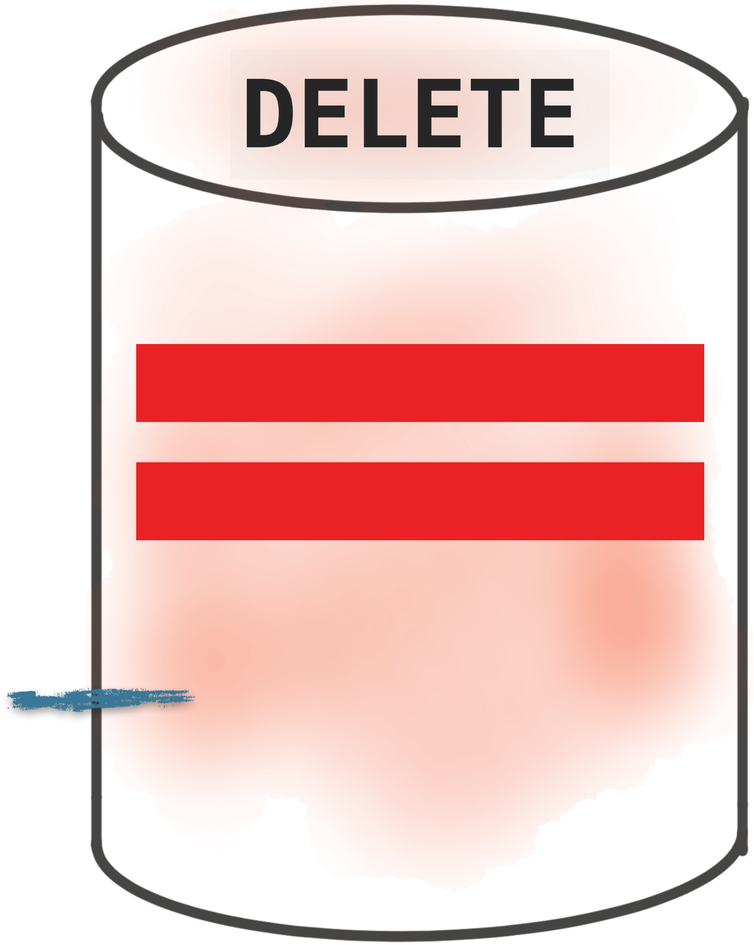


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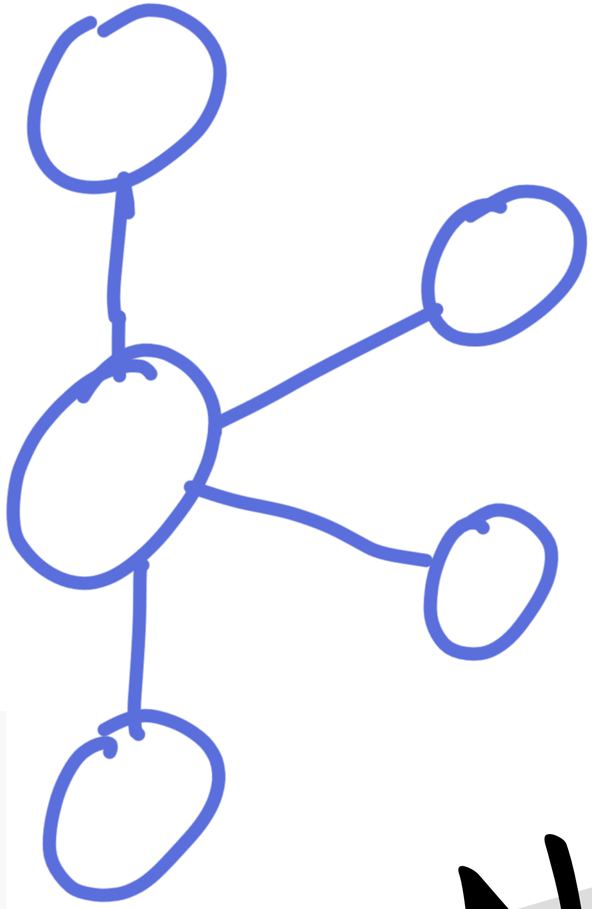
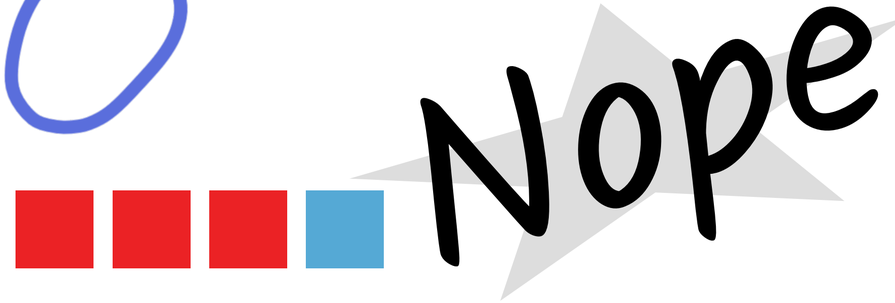
```





Query-based CDC

orderID	status	address	updateTS

```
SELECT *
FROM   orders
WHERE  updateTS >
         previous ts
```

Query-based CDC

orderID	status	address	updateTS
42	SHIPPED	29 Acacia Road	10:54:29

```
SELECT *
FROM   orders
WHERE  updateTS >
         previous ts
```

```
{
  "orderID": 42,
  "status": "SHIPPED",
  "address": "29 Acacia Road",
  "updateTS": "10:54:29"
}
```

Query-based CDC

orderID	status	address	updateTS
42	PENDING	--	10:54:00

```
INSERT INTO orders (orderID, status)
VALUES (42, 'PENDING');
```

Query-based CDC

orderID	status	address	updateTS
42	PENDING	1640 Riverside Drive	10:54:20

```
UPDATE orders
SET address = '1640 Riverside Drive'
WHERE orderID = 42;
```

Query-based CDC

orderID	status	address	updateTS
42	PENDING	29 Acacia Road	10:54:25

```
UPDATE orders
SET address = '29 Acacia Road'
WHERE orderID = 42;
```

Query-based CDC

orderID	status	address	updateTS
42	SHIPPED	29 Acacia Road	10:54:29

```
UPDATE orders
SET status = 'SHIPPED'
WHERE orderID = 42;
```

Query-based CDC

orderID	status	address	updateTS
42	PENDING	--	10:54:00
42	PENDING	1640 Riverside Drive	10:54:20
42	PENDING	29 Acacia Road	10:54:25
42	SHIPPED	29 Acacia Road	10:54:29

Query-based CDC

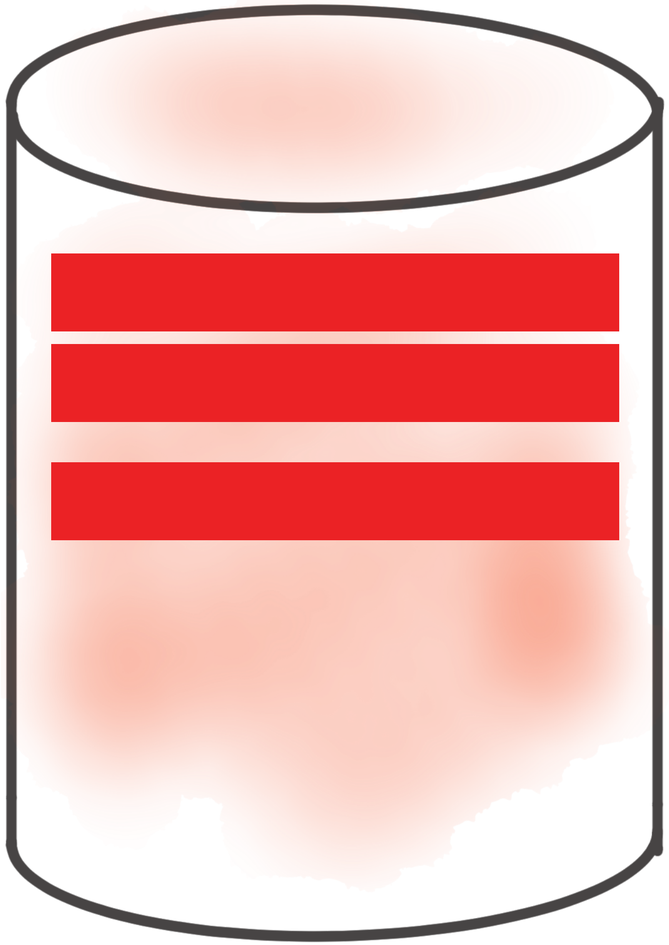
orderID	status	address	updateTS
42	SHIPPED	29 Acacia Road	10:54:29

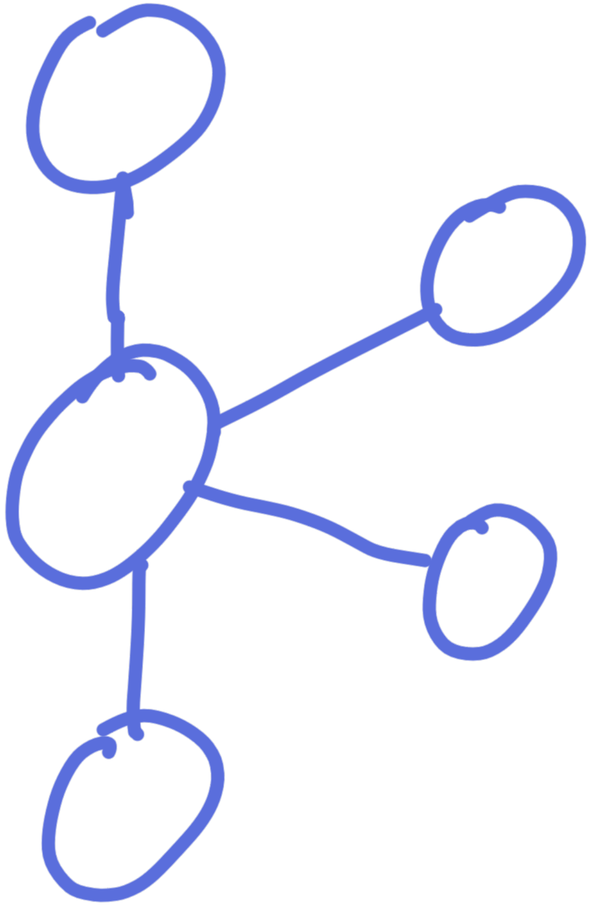
```
SELECT *
FROM   orders
WHERE  updateTS >
         previous ts
```

```
{
  "orderID": 42,
  "status": "SHIPPED",
  "address": "29 Acacia Road",
  "updateTS": "10:54:29"
}
```

Log-based CDC
Event-driven app
Query-based CDC

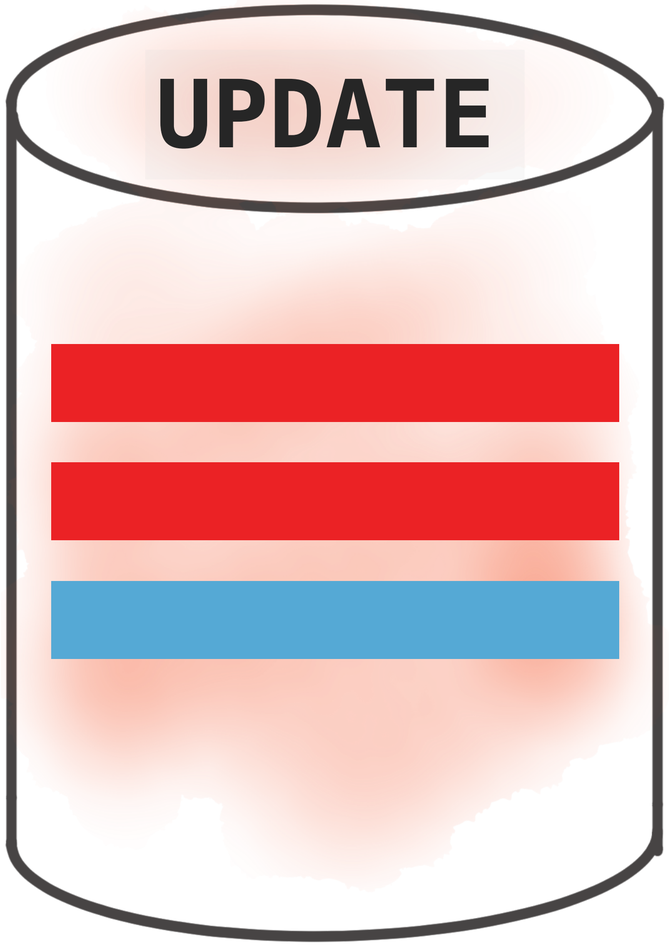
Log-based CDC



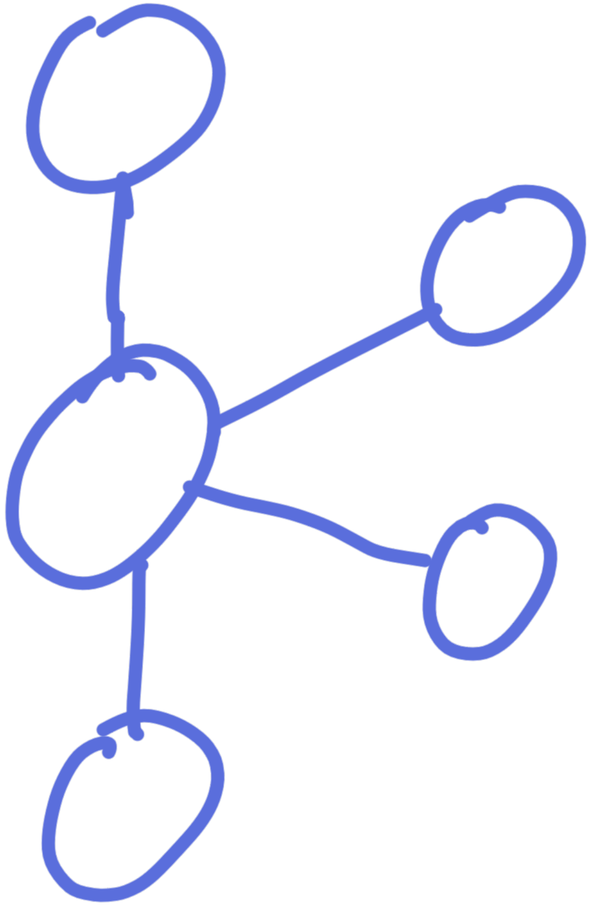


Transaction log

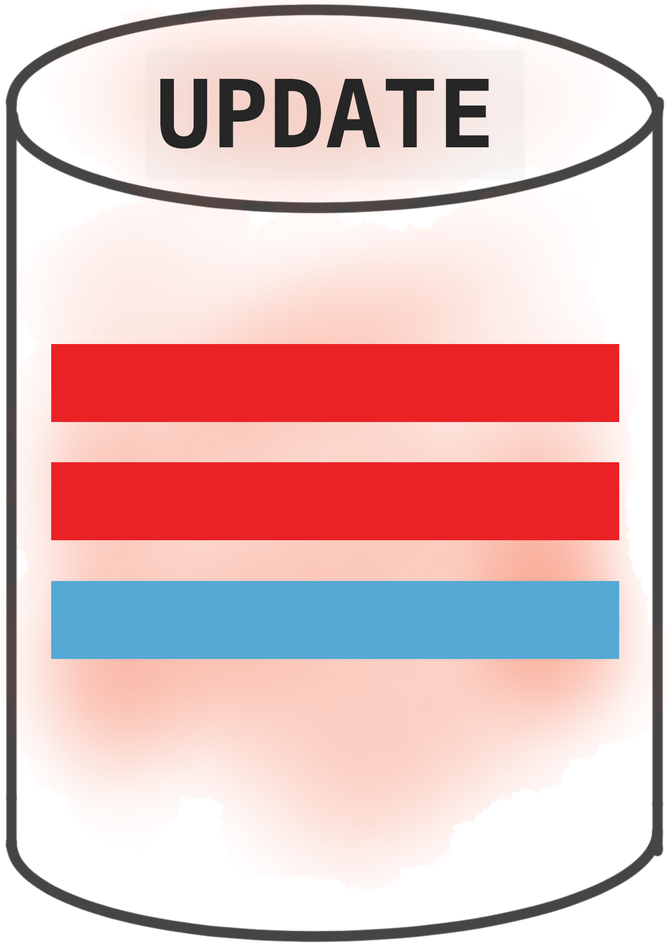
Log-based CDC

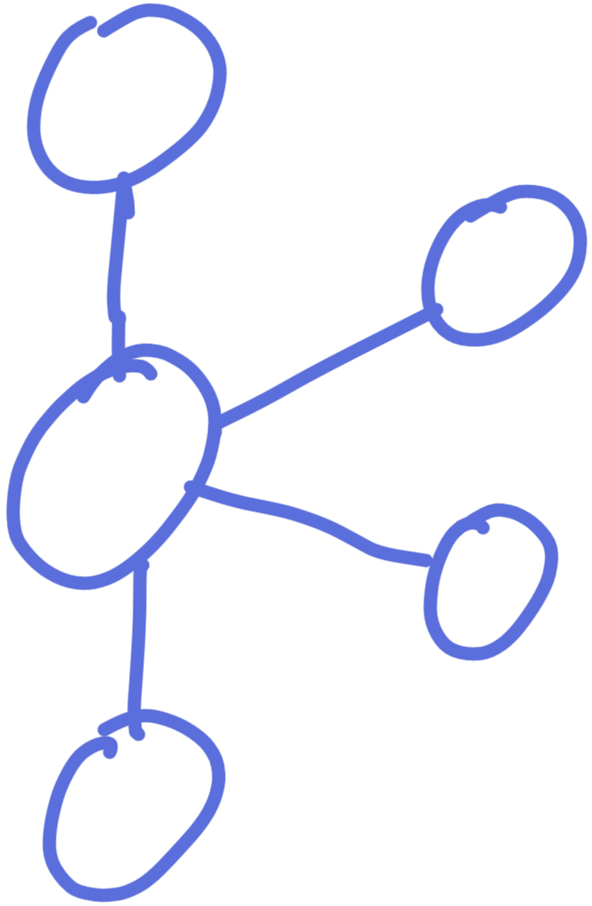


Transaction log

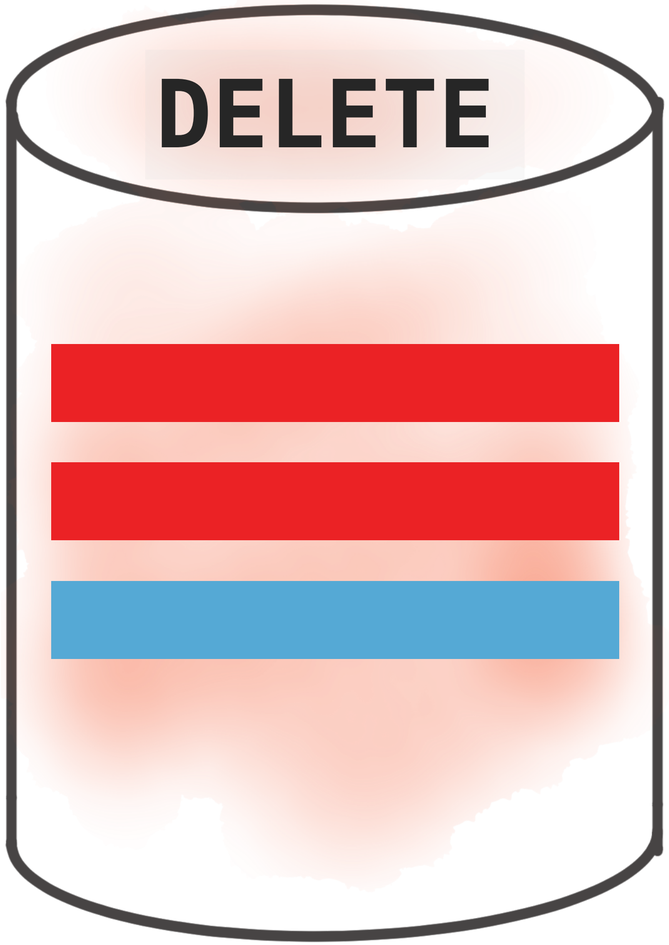


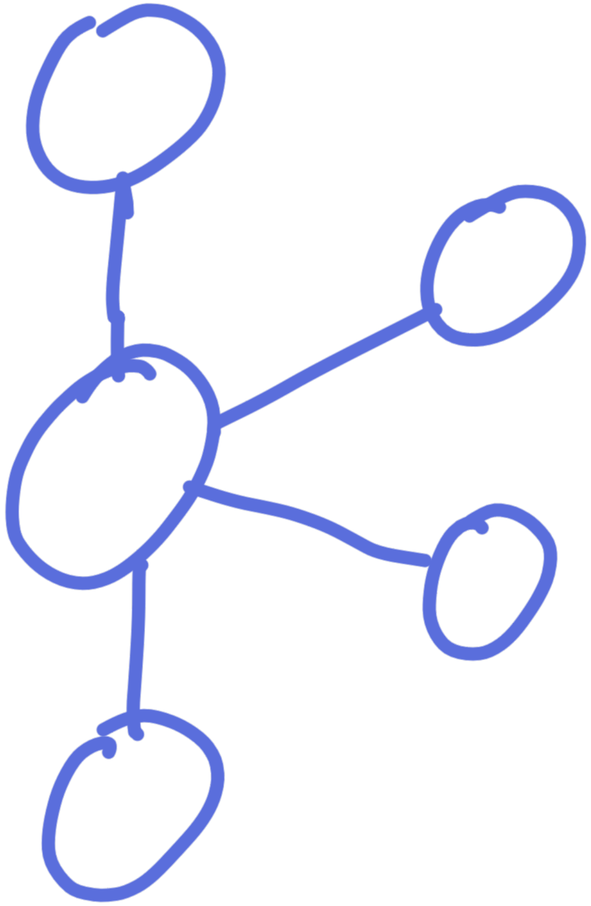
Log-based CDC





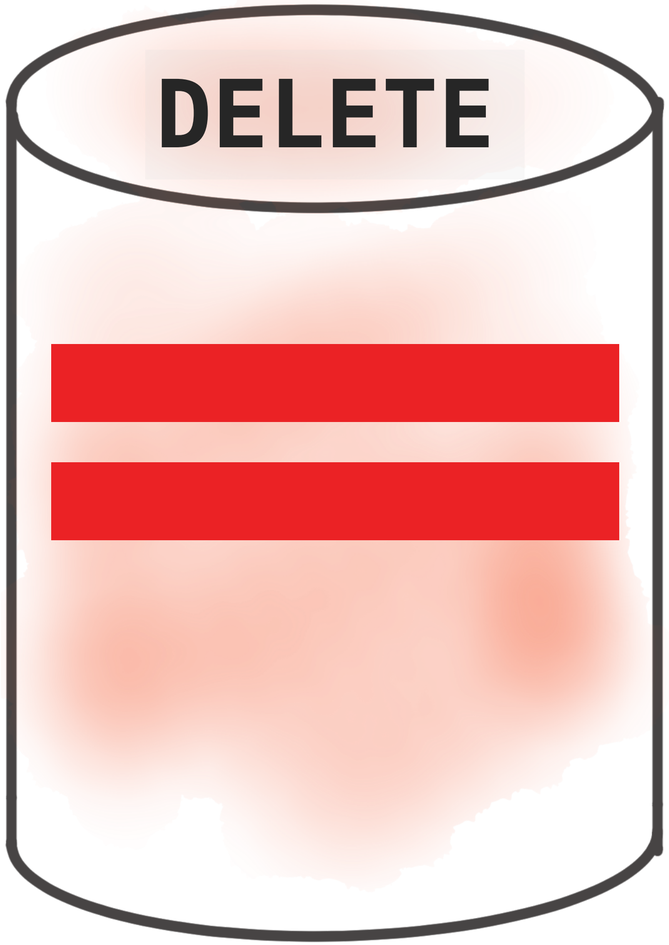
Log-based CDC

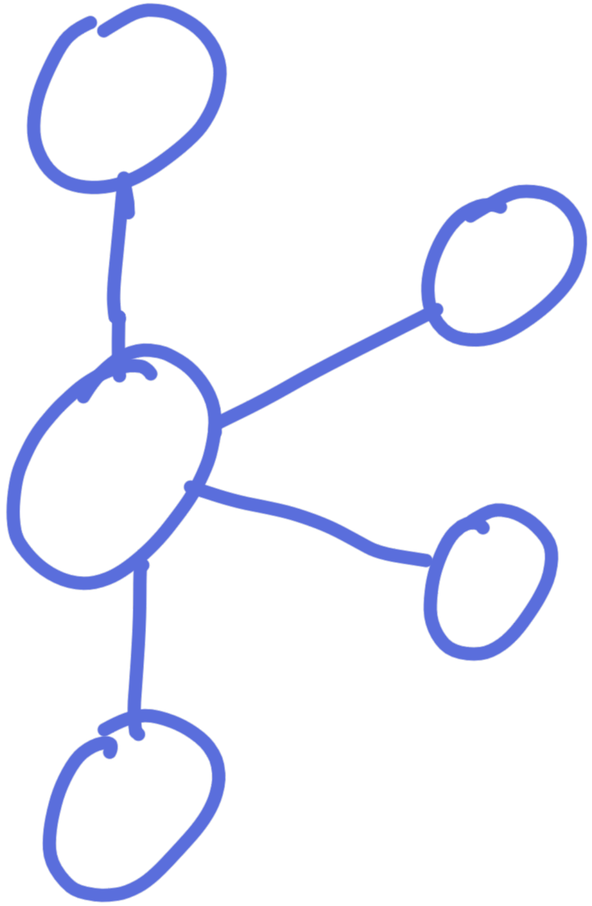




Transaction log

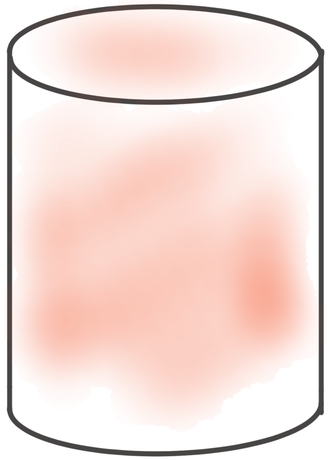
Log-based CDC

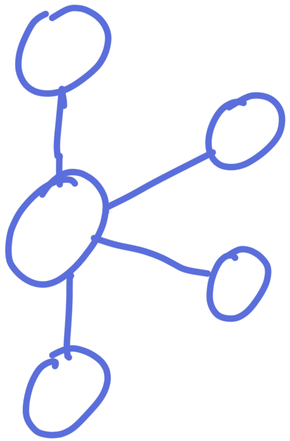




Transaction log

Log-based CDC





Immutable event log

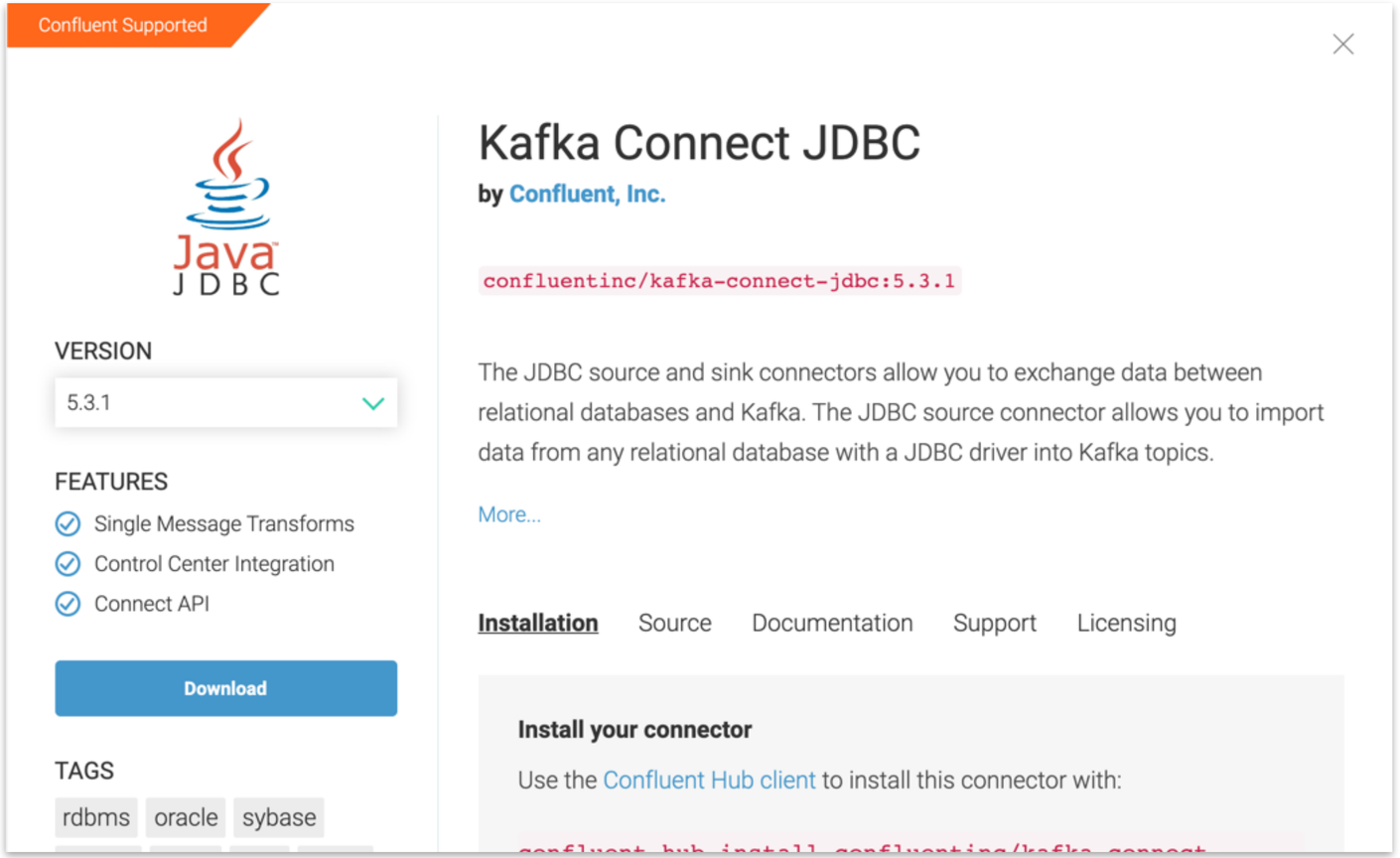
Log-based CDC

- ✅ Greater data fidelity
- ✅ Lower latency
- ✅ Lower impact on source
- 🛑 More setup steps
- 🛑 Higher system privileges required
- 🛑 For propriatory databases, usually $$$

Read more: http://cnfl.io/kafka-cdc

tl;dr : which tool do I use?

- If you're wanting to do query-based CDC, the choice is simple:



confluent.io/hub

Which Log-Based CDC Tool?

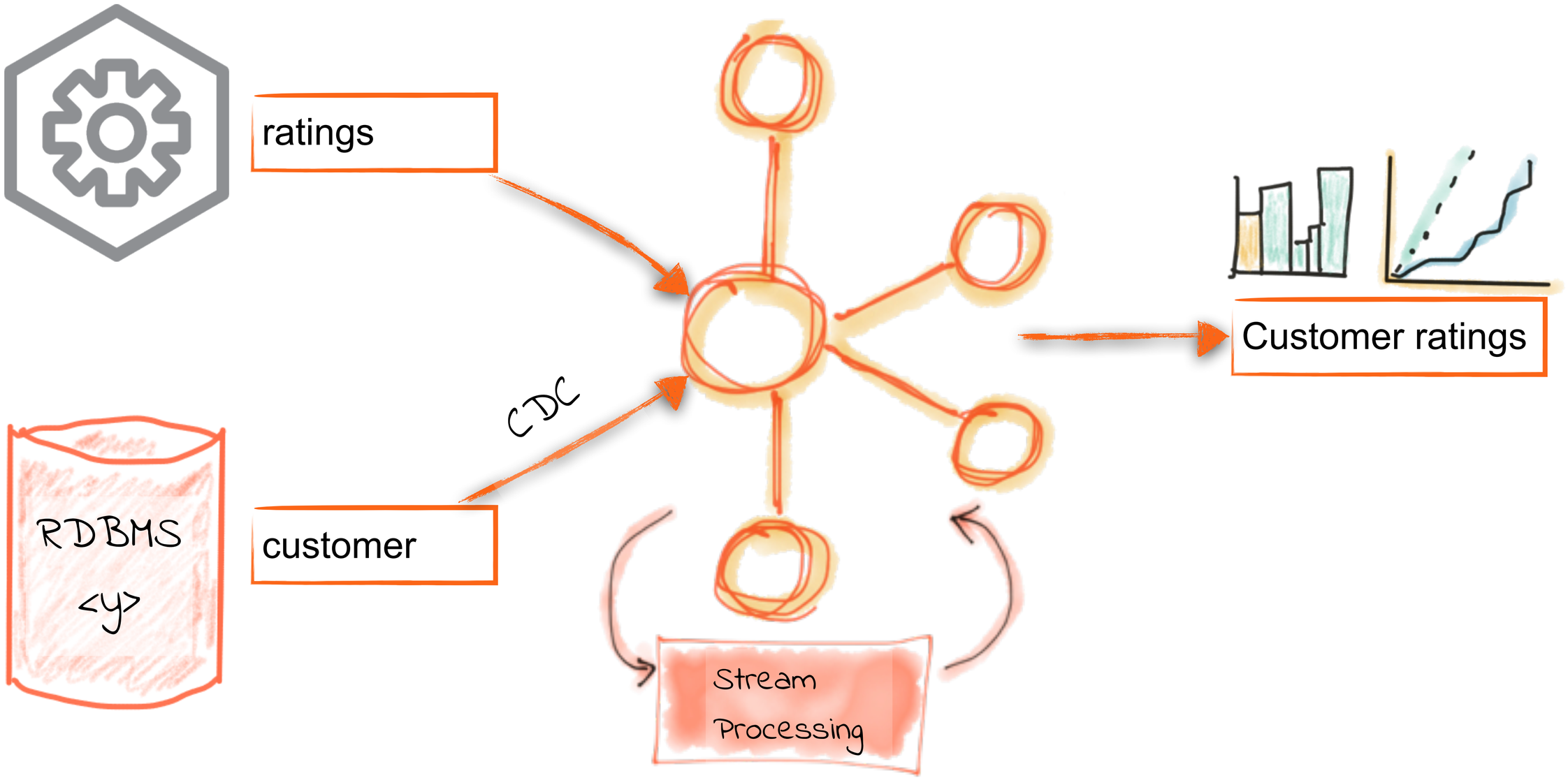
- Open Source RDBMS,
  e.g. **MySQL**, **PostgreSQL**
  - Debezium
  - (+ paid options)

- Mainframe
  e.g. **VSAM**, **IMS**
  - Attunity
  - SQData
  - tcVISION

- Proprietory RDBMS,
  e.g. **Oracle**, **MS SQL, DB2**
  - Oracle GoldenGate
    - Debezium + XStream
  - Attunity
  - IBM InfoSphere Data Replication
  - SQData
  - HVR
  - tcVISION
  - Etc

See also:
https://rmoff.net/2018/12/12/streaming-data-from-oracle-into-kafka-december-2018/

Real-time Event Stream Enrichment

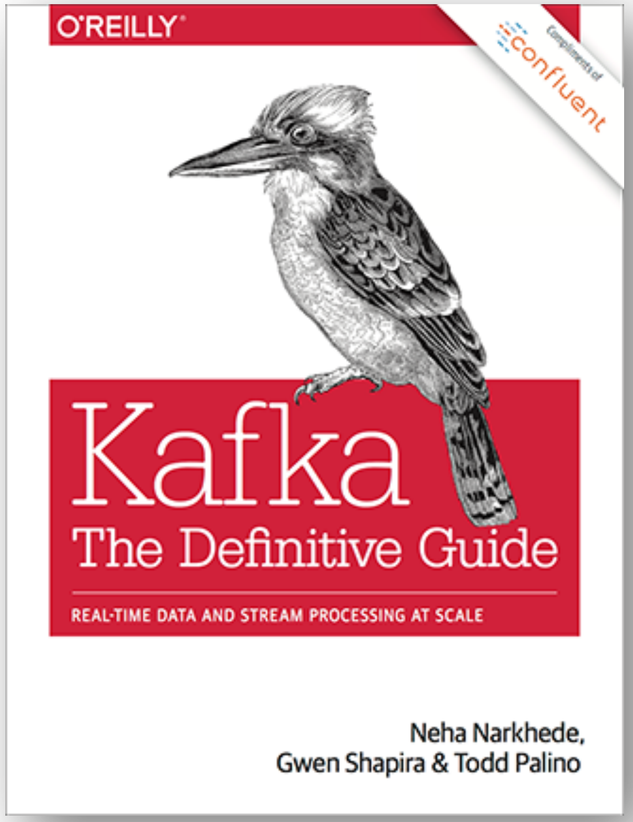


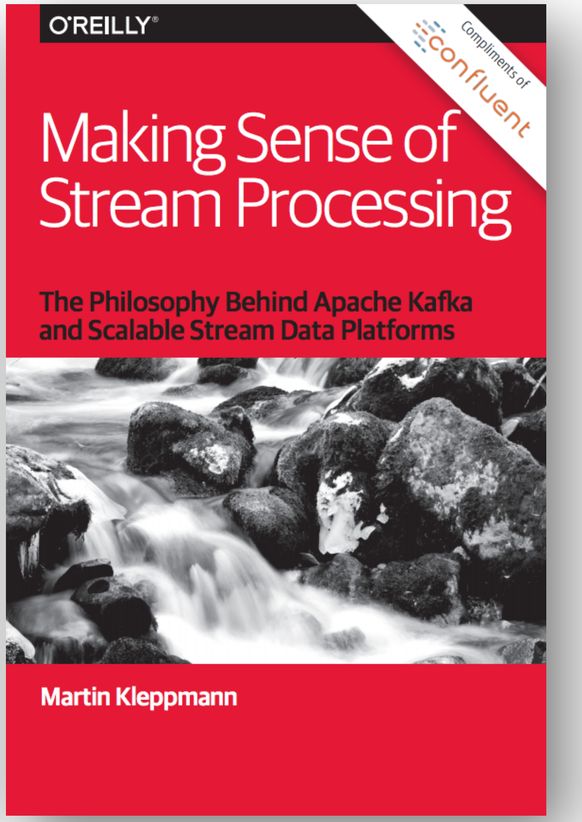
Demo Time!

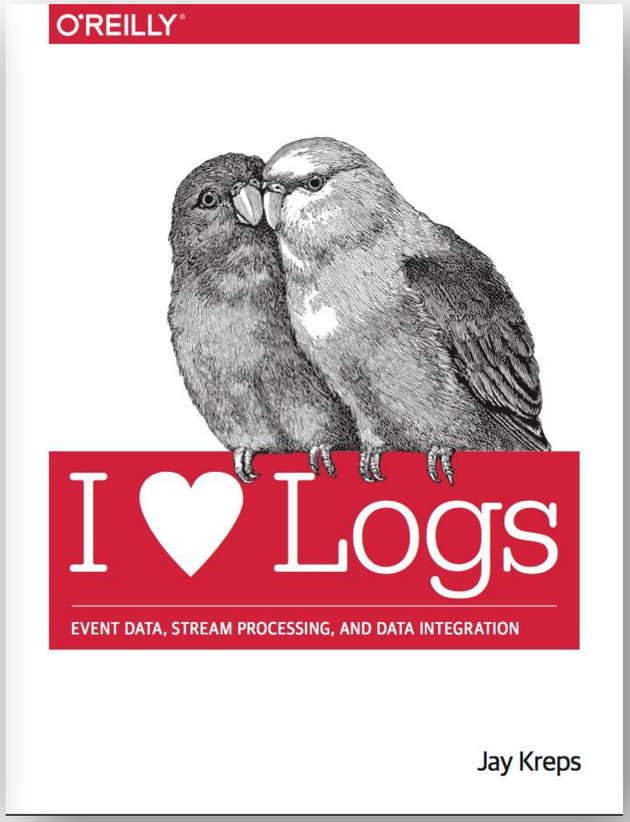
https://rmoff.dev/codetalks19-code

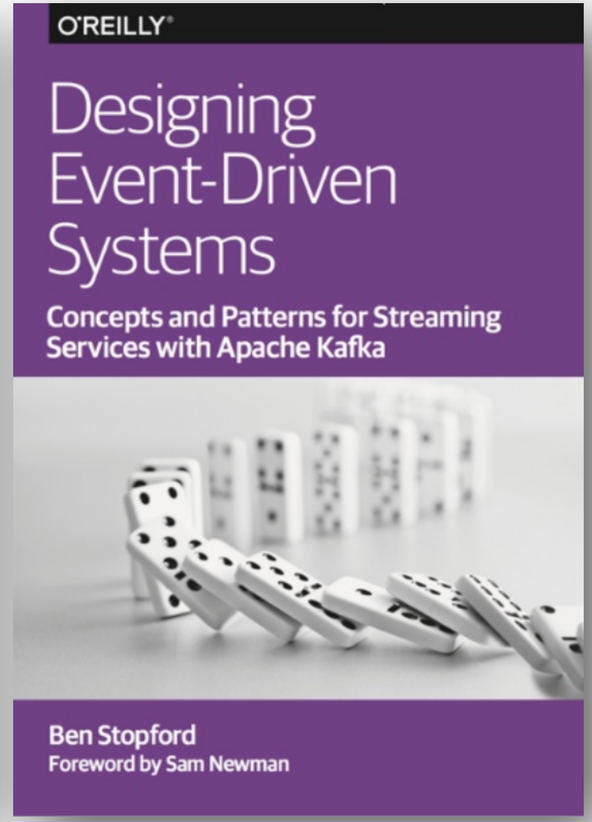
Fully Managed Kafka as a Service

http://cnfl.io/book-bundle









@rmoff #codetalks

#EOF

💬 Join the Confluent Community Slack group at http://cnfl.io/slack

https://talks.rmoff.net